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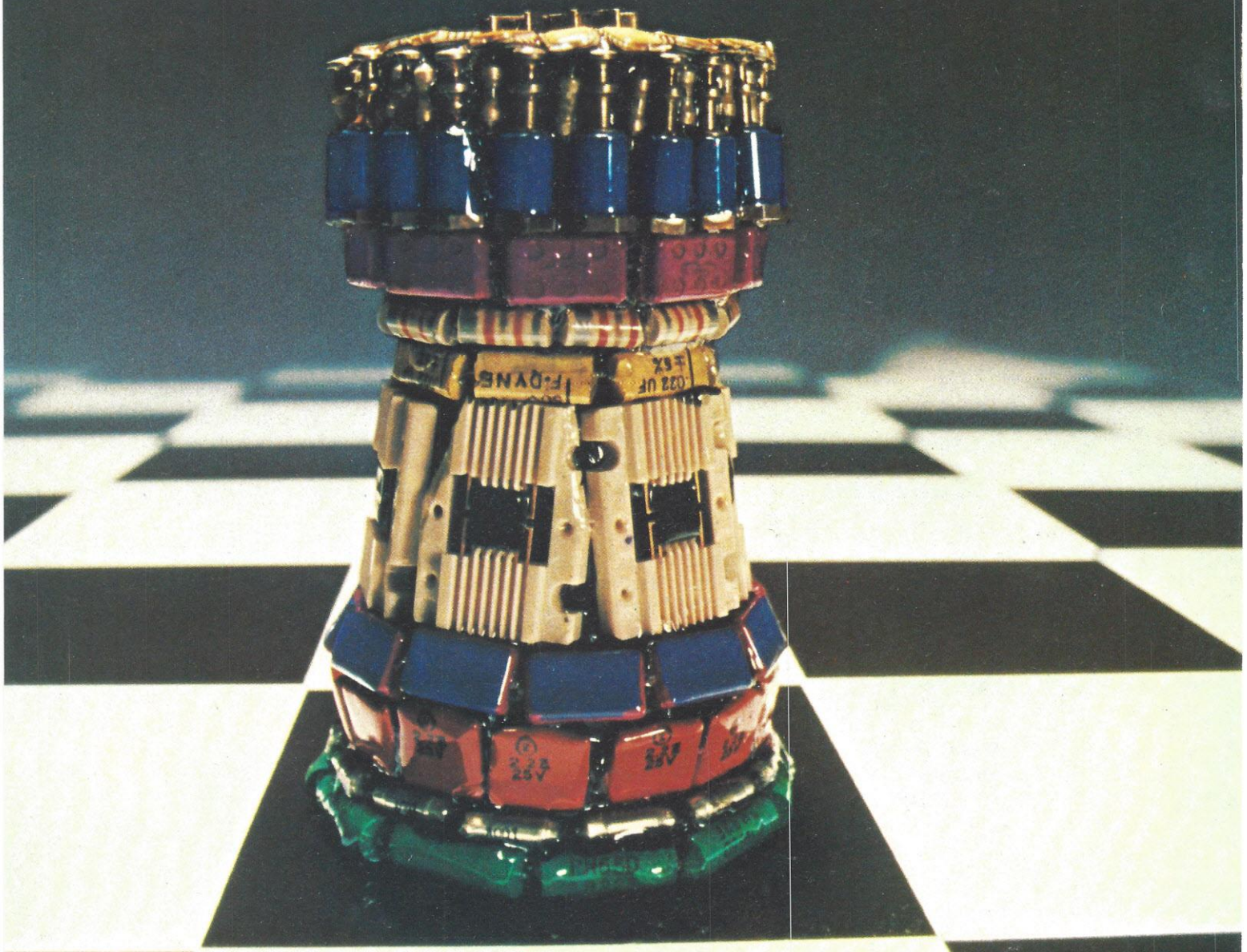
Personal Computing

MARCH 1979



ACM's Annual Computer Chess Tourney

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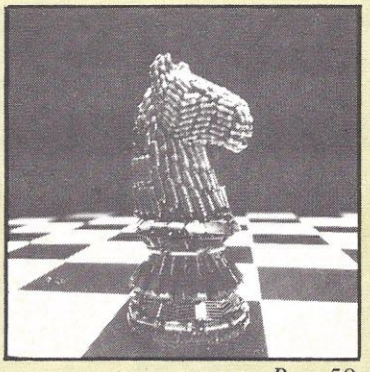
CIRCLE 1

Personal Computing

Publication Number USPS 370-770 MARCH 1979 VOL. III NO. 3



Page 58

Page 14

Page 54

Cover photograph by Jon Buchbinder

DEPARTMENTS

COVER STORY

LAUNCHING PAD

DIGGING IN

ON THE LIGHTER SIDE

Shown on the cover is a "computer" Rook, part of Honeywell's computer-component chess set, the only set of its kind in the world. The complete set is shown on page 58. An enlarged photo of the King is reproduced on page 59.

The 16 pieces, valued at more than $5000, represent the most expensive chess set ever created. It was designed by Joe Veno, a Boston sculptor, who created the pieces from a large assortment of diodes, transistors, wires, switches, integrated circuits, resisitors and other computer parts.

The set is on exhibition at the Waltham office of Honeywell, Inc., 200 Smith Street, Waltham, MA 02154.

Personal Computing

MARCH 1979 Vol. III, No. 3

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FEEDBACK

Bad Connections

Editor's Note: Several readers have inquired about errors in our Phone Directory program (December *PC*). The following notes should clear up the problems.

The open and close parentheses in line 140 are actually "less than" and "greater than" symbols: <, > . Taken together, "is less than or is greater than" means "does not equal".

Line 170, which begins X-LEN(C$) should be changed to read X=LEN(C$).

The READ statement in line 120 reads five items: A$, N$, B$, C$, D$. Thus, each DATA line must contain five items as well, to insure that the READ and DATA statements stay in step with each other. DATA line 1040, as published, contains only four items; you should insert a comma between ROTGUTT and W-212. Likewise, line 8000 contains only four items. You should add an asterisk:

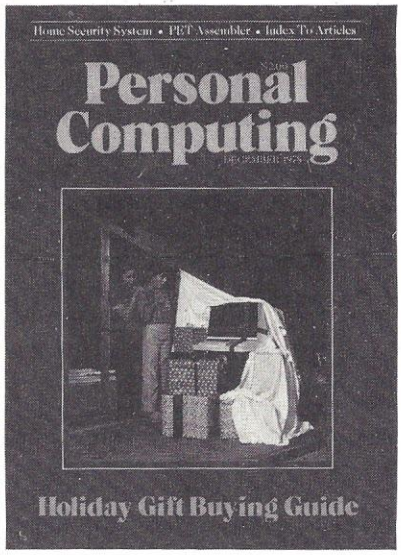
8000 DATA 8000,*,*,*,*

With these changes, the FOR-NEXT loop (lines 110 to 200) will search through the data to select the items you want printed out. When the end of the data is reached at line 8000, the test in line 130 sends control to line 200 (NEXT I). After the program returns to the beginning of the loop at 110, the test line at 115 skips the READ statement (and other now irrelevant lines) until the FOR-NEXT loop is finished. Then control drops to line 210, and the program continues. – *D.W.*

More on Model Rocketry

Dear Editor:

I enjoyed the article, "Model Rocketry for Computer Hobbyists", in the November issue and would like to see more articles on simple but meaningful applications of computers. However, my experience with model rocketry in my high school physics classes leads me to disagree with the authors on certain points. My primary



disagreement is with the assumption that air resistance on a model rocket is proportional to speed squared (A.R.=$k_2 v^2$). Data taken by my students over the last 5 years supports the hypothesis that air resistance on a model rocket is proportional to speed alone (A.R.=$k_1 v$). I have, in fact, tested both possibilities with my own program, and this year's data taken under ideal conditions strongly supports the speed alone hypothesis. This data is also very consistent with data from an Estes Model Rocket Performance Guide from a number of years back.

If the authors have clear evidence to support their hypothesis such as wind tunnel tests over a wide range of speeds, I would very much like to see it. Otherwise there is one other possibility that might resolve the disagreement. It may be that air resistance depends on both speed and speed squared. The speed term would then dominate at the low speeds which are achived with the ½A and A engines used by my students, whereas the speed squared term would dominate at the higher speeds achieved by a C engine. Launching rod friction may also complicate analysis of the results but isn't likely to be a major factor.

In general I disagree with Mr. Stine's statement that "you can calculate the altitude that a given model rocket will fly to within one percent." This would only be true if the engine characteristics were much more consistent than my experience indicates. On the other hand, I've been very successful at predicting average altitudes assuming that air resistance is proportional to speed alone.

There appears to be an error in the program of Mr. Landis. His figures for thrust and time give a total impulse of 11.4ntsec. for the C engine when it should in fact be 10.0ntsec. This creates a 14% error in the most important engine characteristic. Mr. Landis' formula for calculating rocket height (line 290) also has a problem. The change in height term, V*T1, should use the average speed, whereas the final speed is used in this line. I have checked Mr. Landis' formula against mine in my program and found that it creates no significant errors in the final altitude determination, but it leads to altitude changes that are too large in the thrusting phase and too small in the coasting phase.

I like the idea of breaking the thrust in two parts as done by Mr. Landis but haven't done this since it doesn't seem to result in a large improvement. When I checked this on my programmable calculator, I found a difference of at most 1%, and I'm not yet sure which result is more correct. (This is because of the uncertainty introduced by calculating air resistance from the previous speed rather than the current speed.). The results should be checked with an exact solution to the motion equations which, in the case of air resistance proportional to speed squared, seems to require the use of complicated arguments of hyperbolic functions. Laziness has so far prevented me from tackling this.

Robert J. Reiland
Portersville, PA

Author's note: The accepted aerodynamic formula for drag is:
$D = 1/2 \rho A C_d V^2$, where
D = drag forces;
ρ = air density;
A = frontal area;
C_d = dimensionless drag coefficient, a function of shape;

V = velocity of fluid stream.

Except at very low speeds (in the area of feet per hour), drag is always proportional to the square of velocity. There is no question about this equation. It is an accepted fluid dynamics equation and has been used for de cades. It is applicable at most airspeeds up to about Mach 0.8 where compressibility effects begin to show themselves. In all the 21 years of work that I have done in model rocketry, I have used this equation and had it work out on the money every time.

With regard to reader Reiland's claim that I cannot calculate the altitude to which a given model will fly to within one percent, please be advised that I have done so . . . and the records of both national and regional model rocket competitions will show this to be true. It is not unusual to have several competitors in the NAR's "predicted altitude" event predict their altitude right to the nearest meter.

I'd like to refer reader Reiland to my comprehensive book, *The Handbook of Model Rocketry,* Fourth Edition, Follett Publishing Company, 1010 W. Washington Blvd., Chicago, IL 60607.

– *G. Harry Stine*

Author's note: Thank you for your letter. You raise several important questions which certainly could be covered in much more detail, and I appreciate the chance to do so here.

You guess that air resistance, or "drag", on a rocket is proportional to both the velocity and the velocity squared is, in fact, a very shrewd guess. There are indeed two types of drag, these being pressure drag and viscous drag, and the total air resistance on a rocket is the sum of the two: Viscous drag is directly proportional to the velocity, while pressure drag is proportional to the velocity squared. The ratio between these two forces, pressure force/viscous force, is a dimensionless number called the Reynolds number, named for the British physicist Osborne Reynolds (1842-1912). The Reynolds number is probably the most important relationship in all aerodynamics. Numerically, it can be expressed as: $R = (p/\mu)\,VL$, where p is the density of air, μ is the viscosity of air (essentially its "stickyness"), V is the rocket's speed, and L is a characteristic length, either the rocket's length (for body drag) or the fin chord (for fin drag). For a rocket length of 20 cm, the ratio of pressure to viscosity for air at sea level is 0.146 cm^2/sec. We see that in this case pressure drag will be dominant for all rocket velocities over 0.0073 cm/sec. For typical rocket velocities, then, viscous drag is negligible and the drag can be assumed completely proportional to v^2. This fact has been born out in wind tunnel studies too numerous to name.

You are also correct in saying that if drag is proportional to velocity squared, then the exact closed form altitude solutions are complicated hyperbolic functions. These solutions, the Feshkins-Malewicki equations, have been worked out in detail.

With respect to your question of the use of final speed or average speed in program line 290, this is a matter of personal programmer's taste. For infinitely small time intervals, the two approximations are the same and for any reasonably small time interval the difference is negligible (as you have discovered). Using average speed instead of final interval speed is technically a slightly better approach, and is known in mathematics as the "Second-order Runge-Kutta approximation" whereas the final speed is called the "First-order Runge-Kutta approximation". I chose the approximation used only as the simplest one for a novice to follow. Adventurous programmers could even try higher-order approximations!

With respect to the engine total-impulse, the values used were chosen for demonstration purposes; users of this program will of necessity have to change the engine parameters to fit the particular engine they will be using, and should always make sure that the total impulse thus calculated agrees with the actual engine impulse! The advantages of using a two-step approximation to engine thrust, as I did, are slight, and mostly show up in very heavy rockets.

Last, with respect to being able to "calculate the altitude that a given model will fly to within one percent", one of the competition events of the National Association of Rocketry (to which any serious rocket modeller should belong) is called "predicted altitude". This involves predicting an altitude for your model, flying it, and then comparing the prediction with the actual tracked altitude. Winning predictions are often within one per-

"I've never dated a computer before but I'm willing to give it a try."

cent, but if this is truly good prediction or merely dumb luck, only the gods that govern model rockets can say for sure.

– *Geoffrey A. Landis*

Language Debate

R.L. Wexelblat (Feedback, December *PC*) hypothesized that "few programmers who begin their programming life with a language so limited as BASIC ever significantly extend their ability to make full use of the data and program structuring capabilities of higher level languages learned later." The following letter comments on Wexelblat's remarks. – *M.M.*

Dear Mr. Wexelblat:

Though I am a mere novice who entered the world of computing with the purchase of that wonderful little instrument, an Apple II, I found your letter in the December issue of *Personal Computing* to be provocative. Since I am not one of the programmers or teachers of programming from whom you requested a response, I cannot speak about your hypothesis from within the profession, but can only raise some issues from an external point of view.

First, while your hypothesis is specifically about programming languages, I think the hypothesis is generalizable so that the hypothesis about computing languages can come to be seen as only a special case of a wider hypothesis, namely, that only a few people who begin life with a simple language are able or willing to go onto higher languages, whatever higher may mean. I think that in this generalized form, the hypothesis is demonstrably false since *all* people, except perhaps John Stuart Mill who began Greek at three, begin their linguistic studies with simple languages and later, if interest and ability exist, may extend their simple "baby" language to include other, wider, more powerful languages. And if the wider hypothesis is false, the narrower hypothesis is also false. Since it takes only one fact to slay a beautiful hypothesis, any one individual who started out his or her career with one of the lesser languages (whether that be BASIC, PECOS or what have you) and who was able to learn and use the more powerful languages of computing to refute your hypothesis (and assuming there is such an individual) then I would say that your hypothesis is refuted.

Second, I think you should break your original hypothesis into two parts. (1) A personalistic hypothesis, namely: Once some people have mastered something simple, like a simple language, they believe they know it all and can forget about more powerful languages. (2) An objective hypothesis: There is something about simple languages, programming or otherwise, which inherently prevent those who learn them from being able to go on and master "higher" languages. For example, people who learn pre-scientific languages which refer to gods and such have a difficult time learning (much less understanding) advanced scientific languages.

The first hypothesis is a psychological one; the second is a linguistic one. I think your original hypothesis fused (con-fused) the two together, but they are quite different and the evidence for or against either would also be different.

Considerations on the psychological hypothesis: In general, most people are satisfied to learn the folk language of their community, and only a few go on to learn the advanced languages of science, mathematics, etc. You would have to compare the proportion of the entire population that goes on to higher languages with the proportion of programmers who begin with a "simple" language and go on to more highly structured languages. Those people who like to solve problems or are curious are likely to go on, I would guess, while those who are satisfied to get by will stay where they started. This psychological (component of your) hypothesis is not a very interesting one, and is only going to lead up a blind alley.

Considerations on the second hypothesis: Let's assume that a language like Eskimo is simple (descriptive, pre-scientific), while electronics or Fortran are complex, "higher" languages. Does someone who starts out knowing only Eskimo have an inherent, linguistic, structural disadvantage if trying to learn about electronics over someone who grew up in a "scientific" milieu? Is there something about the structure of the Eskimo language that will inhibit development of higher language capabilities? Or, to put it in your terms, is there something inherent within the simple language like BASIC (which is for novices) which inherently inhibits development of higher language capabilities in later life? In order to make much sense out of this hypothesis, you are going to need to set up some standard of higher-lower languages, else there'll only be a babel of argument. Is BASIC simple because it's easy? Is easy the criterion of simple? Hard of "higher"? Is unstructured the criterion of simple? Structured of higher?

General considerations: What would count as a refutation of your hypothesis; What would count as confirming it? Have you set up your confirming-disconfirming standards ahead of time, or are you going to construct them *ad hoc* as you go along? Do you really have an hypothesis, or are you interested in gathering some empirical data on programmers and their abilities? I think you should also add to your questions: What effect do "bad" or "good" teachers or managers have on people who are learning to program? Does a bad teacher of Fortran overcome the effects of a good teacher of BASIC? and vice versa?

Good luck on this research project.

Derek Kelly
Denver, CO

Double-Wide Bug

Gentlemen:

I was fascinated by the double-wide-letter TRS-80 bug described in a letter on page 8 of the December issue.

As you may know, the bug only works when you use the abbreviation for INPUT in line 10. If you use:

10 INPUT "BBEENN

instead of:

10 IN. "BBEENN

you will just get a long list of BBEENN and no double-wide letters.

Howard H. Callaway
Crested Butte, CO

Send your comments, questions or criticisms to Editor, Personal Computing, *1050 Commonwealth Ave., Boston, MA 02215.*

INTRODUCING G2 LEVEL III BASIC.

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CIRCLE 5

RANDOM ACCESS

Medical Group Controls Own Bookkeeping

An anesthesiology service in Wichita Falls, Texas, used to blame errors in their patient's bills on a computer. They were using a timesharing service, and mistakes occurred more frequently than they liked. So, the Wichita Anesthesia Group tried another billing approach.

Today, the group has its own small, desk-top computer and "we are in control," reports Dr. James R. McKinney, partner in the professional association.

The anesthesiology service has installed a system called MEDBACS (Medical Billing and Claims Service), specifically designed for medical office record-keeping. It consists of a MITS microcomputer system manufactured and marketed by Pertec Computer Corporation's (PCC) Microsystems Division, with the system, applications programming and service provided by Altair Computer.

"We came to our system the long way," said McKinney. "Many years ago we went to a computer service and designed the programs we needed that the service could provide. It meant we turned our paper over to them and they did all the processing. We really didn't like the arrangement. When errors occurred, the patients would call and all we could tell them was that it was the computer's fault. That answer satisfies no one."

During the years on computer service, McKinney thought about going in-house, and the recent explosion in microprocessor technology gave him the opportunity. "We were paying $500 a month for the computer service—$6000 a year. The MITS equipment came in at around $13,000, which meant we'd be home free in two years," said McKinney.

Included in the system are a MITS central processing unit with 64K memory, a dual floppy disk drive, printer, CRT terminal and disk-extended BASIC programs. The programs are used for printing insurance claims forms, printing patient billings, printing aged-accounts receivables, keeping track of the doctors who performed surgical procedures patients who've not paid in five months, and dropping patients who have paid up.

"There are many more things we could do," McKinney says. "We're now working on a program to interpret blood gases and spirometry, that kind of thing. It's nothing new—it's done all the time on other machines—but with our system we can do it all here. It is very easy to write a program for this system."

WNCI and TRS-80 Team Up for Car Pool

Radio Station WNCI in Columbus, Ohio, enlisted the aid of a Radio Shack TRS-80 Microcomputer System when transport workers went on strike against the Central Ohio Transit Authority, stranding an estimated daily ridership of thirty thousand people. WNCI immediately launched a program to bring those who had no other means of transportation together with drivers who volunteered to share their cars.

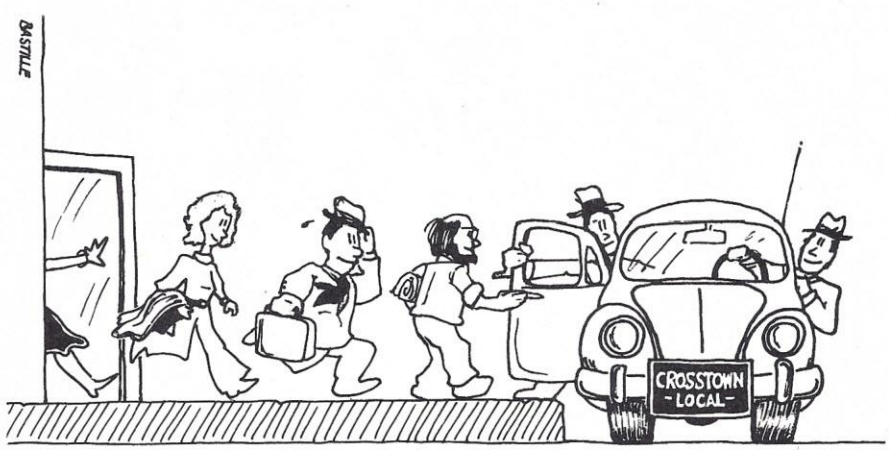
"After the first morning," said WNCI news director Stan Broadway, "it became apparent that there had to be a better way than the stacks of paper we'd accumulated."

A call to Radio Shack's Columbus office resulted in the loan of a TRS-80 system, and the store manager modified a customer information program to put the WNCI/Radio Shack Car Pool Computer program into operation.

"Thanks to the program, we were able to enter driver volunteers, their address, telephone number and zip codes of origination and destination, and other information," Broadway said. "When a person needing a ride called, we quickly matched them up with someone close by, going to roughly the same destination.

"As an example of how well the computer itself worked, we first entered the list of drivers, then double-checked the list of riders we had on waiting. Immediately six links we had simply overlooked were produced.

"We think the program was able to accomplish a very important task," said Broadway. "We are considering launching a real computerized car pool promotion and setting up permanent car pools to help in conservation and traffic reduction in the future."



Cement Supply Logistics

Construction crews know that when you need cement, it'd better be there. The problem, which belongs to the supplier, comes down to logistics — how to get the right quality and quantity to the right place at the right time. A complex proposition to begin with, the logistics get even more complicated when the supplier produces various types of cement in geographically widespread factories and sells them through a broad network of sales, branch and peripheral offices.

Cementir-Cementerie del Tirreno, with headquarters in Rome, is one of Italy's leading cement suppliers. With seven factories, four branches, 11 sales offices and 10 peripheral offices, it serves most of the country.

The company deals with more than 10,000 customers: builders, contractors and cement mixing centers. An average of more than 1000 orders a day are taken and the company's computer system prepares 250,000 invoices a year.

Cementir has simplified its logistics with a centrally controlled data communication network of computer terminals. The network is tied by leased telephone lines to two Honeywell Level 62 computers, each with 256K bytes of main memory and disks with a total of 174M bytes of auxiliary memory, located at the Rome headquarters.

The system enables each factory to plan shipments and production schedules based on orders received by sales offices the previous day. The central office in Rome verifies shipments and supervises the production of invoices prepared at the sales offices the day following deliveries.

By retaining centralized control of all data relative to orders, shipping, stock levels, billing and customer accounting, headquarters management and each sales office can determine order and customer status at any given moment, since the entire system operates online in a transaction mode.

The central system stores and manages information on the total operation, such as pallet availability, sack storage, delivery situation trends, payments, production statistics and transportation details. All this information is available to the factories and offices at any time through local terminals. The entire information bank is accessed and continually updated in 21 disk files under the supervision of a monitor operating with standard Level 62 software.

Computer Seminar

Do you really need a mini or microcomputer? If so, which system would be best for you?

A one-day seminar is being held to help you find answers to these questions. Sponsored by Creative Strategies Unlimited, the seminar includes the following eight sessions: Computer decision process; How to define lifestream systems crucial to profit; Should I use application packages?; How to chart the flow of critical transactions; How to increase profits through automation; How to evaluate available small business computer systems; Your present information costs in personnel, time, out of pocket expenditures, material and lost decision time of ineffectiveness; and How to acquire a small business computer system.

The seminar will be held in Atlanta, March 15, at Dunfey's Royal Coach; and in New York City, April 3, at the Rye Town Hilton. Course fee is $175. Contact Creative Strategies Unilimited, 6 Beacon St., Boston, MA 02108; (617) 326-4103.

Info for NCC'79 Participants

A call for participation has been issued for the Personal Computing Festival of the 1979 National Computer Conference to be held June 4 to 7 in New York City. The four-day Festival at the Americana Hotel will feature technical sessions, panels and tutorials, as well as applications demonstrations and commercial exhibits devoted to microcomputer products and services.

All individuals interested in personal computing, including hobbyists as well as computing professionals, are invited to participate in the festival by presenting a paper, giving a talk, organizing a panel, delivering a tutorial or demonstrating a non-commercial application, show organizers said. For details on participating in the festival, contact Jay P. Lucas, program co-chairman, 3409 Saylor Place, Alexandria, VA 22304; (703) 751-3332 (home). The deadline for receipt of final papers in camera-ready format is March 15, 1979.

Potential authors will be mailed a Festival Author's Kit, containing instructions and necessary materials for preparing papers in a camera-ready format. Program sessions currently in the planning stage cover education, assistance for the handicapped, investment analysis, ethics and crime, legal aspects, professional applications, maintenance, computer music, art and graphics, inter-computer communications, robotics, small business systems, as well as modelling, simulation and games.

"Personal Computers in Other Hobbies" will be chaired by *Personal Computing* editor and publisher Harold G. Buchbinder. The session will deal with combining personal computing with other hobbies such as chess, model rocketry, audio, gambling and model railroading. Persons interested in speaking at the session should contact H.G. Buchbinder at *Personal Computing*, 1050 Commonwealth Ave., Boston, MA 02215; (617) 232-5470.

Thomas Throop, editor of the Bridge column in *Personal Computing,* will give a talk on computer bridge. Anyone with a bridge-playing program who would like to submit it for demonstration purposes to the Festival is invited to contact *Personal Computing,* Computer Bridge Department, at the Boston address. Those interested in a panel discussion on the subject of computer bridge can indicate this interest in the same communication.

Additional information on the 1979 National Computer Conference may be obtained by writing NCC '79, c/o AFIPS, 210 Summit Avenue, Montvale, NJ 07645; (201) 391-9810.

Computer systems are becoming almost as common as furniture in many offices. In an effort to make the systems visually attractive, Digital Equipment Corporation is offering original works of art for its line of small business computers.

The semi-abstract seri-graphs were created by graphic artist and printmaker Corita Kent. Each series consists of a wall banner and two prints of a second design for mounting on a side panel of a new workstation/desk. The prints, offered as options with Datasystem purchases, are priced at $125 for each set of three prints.

London Users Club

During a recent meeting of the North London Hobby Computer Club, the members formed three new users groups: PET Users Group, Business Users Group and a Homebrew Activities Group. During the same meeting, plans were made for a lecture series during 1979, offered free to members. Courses will include: Introduction to Computing; Introduction to Machine Code/Assembly Language; Introduction to BASIC; Introduction to Digital Electronics; and Structured Programming—Introduction to Pascal.

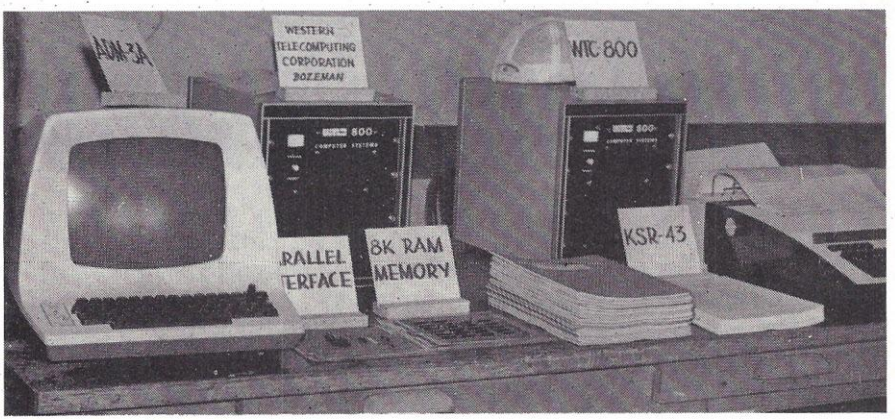
For more information contact Robin Bradbeer, Department of Electronics and Communications Engineering, Polytechnic of North London, Holloway Road, London, N7 8DB.

Kalispell Computer Fair

In the middle of 1978 there was a computer fair in Kalispell, MT. So what, you say. Well, what has happened in this rural community of 11,000 may suggest a trend developing throughout the country in similar towns.

Two years ago there was virtually no computer activity in Kalispell. At that time only the largest institutions had even begun to enter the field; there was one commercial data facility and no hobby activity at all. A computer club was formed by one lone member and grew very slowly.

Then, in 1977, the state obtained a National Science Foundation grant to permit limited introduction of computers into the high schools. Bayliss Cummings, in charge of data processing at Flathead Valley Community College, was made project director for western Montana and spent the 1977-78 school year helping 10 widely scattered rural schools share one Wang 2200. Because of his efforts and those of a number of high school science teachers, hundreds of rural students experienced their first exposure to computing.



Following the 1978 school year, Flathead Valley Community College hosted a workshop and computer exhibit for the NSF participants and other interested persons. Four manufacturers responded with displays and demonstrations. The IBM 5110 and Radio Shack TRS-80 drew the most attention. Also shown were an Apple II, the WTC 800 (a local product from Bozeman, MT) and the KIM 1 belonging to one of the participating teachers. The attendance of less than 40 might seem small by some standards, but was a real achievement in such a small community. Featured speakers were Dr. Stanley Robinson of the University of Washington and Dr. Banaugh of the University of Montana.

As the Kalispell Fair and the National Science Foundation program demonstrate, the "computer revolution" is beginning to affect rural areas and small communities as well as urban centers. We will all benefit as this trend continues.

–Ernie Brooner

Computer Keeps Tabs On Runners

Seconds after the first fifty runners crossed the finish line at the New York marathon, biographical information was available on all of them, thanks to a computer information system.

The New York Marathon, with more than 11,000 runners, used a data information system, donated by the New York Telephone Company and organized by MTI, a Long Island-based firm of systems application engineers. The heart of the system was housed in a van stationed 50 feet from the finish line according to the New York Road Runners Club, sponsors of the marathon. The system in the van consisted of three wands, an Intel Microcomputer, Model 80/20 and a Diablo 200 character/second printer, Model 1660.

Part of the system not in the van, another Intel microcomputer, Model 80/20, was at a remote location in Manhattan. This computer contained biographical data on all 11,000 runners in the New York Marathon.

Success of the system began at the finish line. With three finish gates to accomodate the thousands of finishers, only one gate at a time was used for the first finishers. A judge stationed at the gate held an impulse system. As each runner flashed through the gate, the judge depressed the relay, which showed only that someone had crossed the finish line and at what precise moment. This information was fed to the microcomputer in the van.

All the runners had a quick pull-off coded strip attached to the number they wore. As the runners came through the finish gate, the volunteers from the Road Runners Club removed the strips and placed them in order of finish on a spindle. The coded strips were taken to the van and read by one of the three wands. The microcomputer correlated the timing from the relay click at the finish line with the strip coded number reading from the wand. The number and timing were then relayed to the remote computer, which sent back the biographical information and number of the runner to the Diablo printer—ready to be given to the press. The entire operation in the van had taken only seconds.

With interest in long distance running increasing, the success of this sytem could be the prototype of such operations in marathon races throughout the nation, believe officials.

Looking Ahead: Teleconferences and Computer Mail

Businesses in the future could be conducting conferences using computer systems and distributing mail electronically, predicts John B. Fried of Battelle Columbus Laboratories.

"Computer systems have made tremendous advances in the 1970's—most notably in the development of data-base technology—and the coming decade should see new computerized devices for information transfer and utilization," Fried said.

He believes teleconferences will one day eliminate much of the travel now necessary to hold meetings and will improve information transfer between remote groups. With teleconferences, a computer provides hardware and software necessary to store comments.

"The outline of the conference, along with a series of comments on a topic, is stored in the computer," Fried explained. "participants may review and enter their own comments. Any participant may make entries, which can be directed to one or more participants."

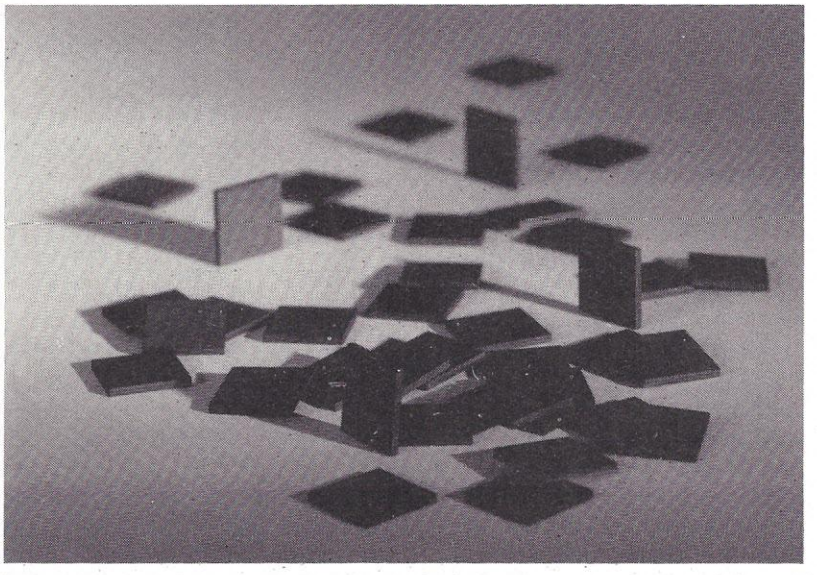
Fried also predicted that organizations would be switching from normal paper distribution to electronic mail, which he said, "offers a corporation a superior, automated alternative to its paper communications flow."

Another future alternative will be voice-recognition systems, Fried said. With these sytems a person can speak into a microphone connected to a computer and be "understood" by the computer system. In the future, voice-recognition systems could permit users of on-line information retrieval systems to make queries with very little terminal keying.

"To date, the greatest accomplishment has been the development of data-base technology," Fried said. "Computerized data bases, which logically structure data and information, are finding many applications in industry. This is particularly true of on-line data bases, where information is stored at a centrally located commercial organization."

According to Fried, one of the fastest growing technological areas involves on-line bibliographic data base searches for scientific and technical literature. More than 90 percent of all scientific and technical articles published today are available through such systems.

"The use of these computer systems by a nonprogrammer is possible," Fried said, "although intermediaries usually access the data base for others. The coming decade is certain to result in additional new and exciting computerized systems for information transfer and utilization."



They're not dominoes, and they're not chocolate mints. Rather, the picture above shows ferrite permanent magnet plates used to create bubble memories for computers. Bubble memories, one of the hottest topics in computing circles these days, require smooth, very precise magnetic fields to create the "bubbles" inside garnet chips. These magnetic plates shown above, produced by Ceramic Magnetics of Fairfield, NJ, create the magnetic fields bubble memories need.

Many experts predict bubble memories, presently expensive, will find increasing numbers of uses as prices drop in the next few years. Suggested applications include intermediate storage for floppy disks, mainframe memory, typewriter memories, point-of-sale terminals and calculators.

Computerized Sales Staff

A new breed of "sales persons" are being hired in a network of more than 80 catalog showrooms. And, these sales persons, which are not people, are selling everything from blenders to diamond rings, offering alternatives when items are out of stock, controlling all sales transactions, and giving central headquarters daily inventory and sales reports.

Actually the sales staff involved is a network of computer systems that provide improved customer service and efficient inventory control for Service Merchandise Company, Inc., with catalog show-

rooms spanning a 19-state area, explained Roger Lancina, Assistant Vice President, Minicomputer Operations.

Unlike conventional retailers, catalog showrooms eliminate the need for sales people, letting the merchandise—all of which is on display—sell itself. The economy of this method is reflected in lower priced products.

"Each of our showrooms carries approximately 15,000 items including small appliances, sporting goods, jewelry, toys, cameras, televisions and stereos—almost everything but clothing and large appliances such as washers and dryers," Lancina said.

"With that much merchandise in that many stores, we needed a quick and effective way of locating the items for the customers and keeping track of inventory. So we've equipped each of the showrooms with a computer system consisting of a 16 bit minicomputer, a 10 megabyte disk drive, two medium speed printers and 23 Lear Siegler ADM-1 video display terminals," Lancina said.

When customers enter the showroom, they pick up a clipboard with an order blank at the door and freely wander around the showroom facility.

Each item has a ticket with a stock number, the retail and Service Merchandise prices and a product description. Customers mark which items they want on the order form and bring it to an order desk.

"Each operator at the order desk has a terminal and a printer," Lancina pointed out. "There's a second printer in the warehouse. The operator enters the stock numbers into the terminal, gives the customer the price and in seconds can tell if the item is in stock.

"If the store does have it, the terminal cues the warehouse, and the printer in that section tells the warehouse personnel what product to get, how many and where it's located.

"While the item is being placed on a conveyor belt going back to the order desk, the original operator is completing the sales transaction," he said. "A code keyed in to the terminal opens the cash drawer and by the time the customer has paid, the item is at the desk. The entire process takes a few minutes.

"The new system lets the customer know immediately if we're out of a certain product and and the terminal will display up to five similar alternative items in the same price range that are in stock," said Lancina.

Service Merchandise now has a duplicate computer system with extended memory at the home office that polls all of the stores seven days a week through high quality phone lines, gathering both inventory and sales data.

"We're now using the computers to keep track of employee hours and payroll. We keep reports at the individual outlets and inform central headquarters. We're also able to use the system for internal purposes where a consumer is not involved," Lancina concluded.

Ugly BASIC

Reprinted from the Australian computer journal COM-3, *edited by Timothy Mowchanuk.*

— by Colin Wells,
The Downs School,
Dartford, Kent

I have recently come across a worksheet I made up to give my CSE Computer-Studies-groups practice at *dry* running BASIC programs, which I originally produced several years ago.

My pupils have found this to be good fun — and surprisingly difficult unless *careful* records are kept. It must be emphasized that this program is by no means supposed to be a good example of programming style — in fact, all the GOTOs would make many programmers scream in horror. However, they are still useful as a form of mental calisthenics. (There are no prizes, unfortunately, other than the feeling of self satisfaction knowing that you can do as well as a computer — in some cases).

PROBLEM: FIND THE HIDDEN WORD WITHOUT THE USE OF A COMPUTER

```
 10      GOTO 210
 20      FOR A=1 TO 3
 30      IF A  1 THEN 50
 40      GOTO 140
 50      FOR B = 1 TO 2
 60      IF A  3 THEN 90
 70      PRINT "E";
 80      GOTO 130
 90      IF A = 2 THEN 120
100      PRINT "M";
110      GOTO 130
120      PRINT "T";
130      NEXT B
135      GOTO 160
140      PRINT "0";
150      GOTO 50
160      IF A  2 THEN 180
170      GOTO 190
180      PRINT "I";
190      NEXT A
200      GOTO 230
210      PRINT "C";
220      GOTO 20
230      END
```

Do you have a "Human BASIC" program that can stump our readers? Send it to Personal Computing *magazine, 1050 Commonwealth Ave., Boston, MA 02215.*

Student Programming Contest

The 1979 Computer Programming Contest, sponsored by the Association for Educational Data System, recognizes students who have developed outstanding computer programming projects. Students in grades 7 through 12 are eligible. First prizes will be awarded in the categories of business, biological and physical science, computer art, computer science, games, simulations, mathematics and Junior High (grades 7, 8 and 9). Junior High applicants are eligible for all other categories as well. Contact AEDS, 1201 Sixteenth St., N.W. Washington, DC 20036.

the $988 Surprise . . .

If you haven't looked carefully at the Level-II 16K TRS-80, you're in for a big surprise! Level-II BASIC gives TRS-80 advanced features like comprehensive string handling, multi-dimension arrays, multi-letter variable names, named cassette files, full editing, integer arithmetic, single (6-digit) and double (16-digit) precision arithmetic, formatted printing, memory-mapped video (print directly at any of 1024 screen positions), 128x48 video graphics (may be intermixed with text), error trapping, auto line numbering, TRACE, PEEK and POKE . . . to name just a few. Because Level-II is in ROM, TRS-80 powers-up ready to go with the full 16K RAM available for your use.

This means TRS-80's memory is equivalent to a 28K RAM-based system.

New for 1979—TRS-80's numeric (calculator) keypad included on every 16K computer, and available as an add-on for present owners.

TRS-80's modular design allows easy expansion. Add up to 48K RAM, Expansion Interface, printers, 1 to 4 Mini-Disks, RS232C, telephone acoustic couplers, Voice Synthesizer, dual cassette recorders, our System Desk and Printer Stand. Surprisingly, these are not promises of things to come, but real products being delivered right now. Software from games to General Ledger are available, with more cassette and disk software being added monthly.

Radio Shack's 58 years of consumer electronics leadership, our 50 regional repair centers (growing to 100 this year), our new Radio Shack computer centers, and our NYSE-listed billion-dollar parent, Tandy Corporation, insure that customer support is always available right where it should be—locally.

So if you haven't seriously looked at TRS-80 yet, ask your local Radio Shack for our new 20-page fact-filled catalog and be prepared for a $988 surprise. Surprising power—features—price—support! Level-II 16K systems include everything pictured, plus the manual. Better to be surprised now . . . before you choose the wrong microcomputer system.

Personal Home Expense Records

Where Did All the Dollars Go?

BY ROGER ULASOVETZ

Budgeting is easier if you have evidence right before you showing exactly what happened to your money the month before. The following program provides you each month with 10 pages recording all expenses incurred for the past month.

Each expense (food, clothing, repairs, etc.) is labeled as a separate account. You may call for the printing of an individual report at any time, and only the account asked for will be printed. If all reports are solicited, then each report will be printed on a separate sheet and a summary report will also be generated. Ten pages of printout at the end of each month are separated, giving the following information, listed in the order of printing:

Food expenses – groceries, eating out and snacks, but not items like paper towels and soap that are not food but are available at food stores.

Clothing expenses – clothes or materials to mend or make clothing.

House maintenance expenses – repairs for existing parts of a house: leaky faucets, broken stairs, planting flowers in existing flower beds. (Making new flower beds comes under House improvement expenses.)

House improvement expenses – building a patio, planting new shrubs, installing a swimming pool, adding a downstairs bedroom or family room.

House running expenses – power, water, heating, telephone, soap, linen, dishes, paper towels, scatter rugs, toothpicks, etc.

Entertainment expenses – movies, cable TV, vacations, hobbies, newspapers, etc.

Electronics expenses – or any special hobby or field suited to your needs.

Miscellaneous – items that don't fit anywhere else.

Summary reports – a summary of the totals for all the above reports.

The Program Listing shown includes five data lines as an example (lines 1000 to 1004). Each input data line has the same format:

NNNNDATA"TYPE",YYMMDD, "PARTICULARS",AMOUNT

NNNN is the line number; DATA indicates a data line; "TYPE" indicates the account associated with the data line; YYMMDD indicates the date for the expense; "PARTICULARS" is a description of the expense (maximum length for this entry is 42 characters including spaces); AMOUNT indicates cost.

The names of the accounts are listed in Table 1.

Data lines start at line number 1000 and continue as far as necessary. At the end of the month, after all reports are printed, lines 1000 to the last data line before line 9999 are deleted and a new month is started.

Table 1

FOOD – food
CLOTHES – clothing
HMAINT – house maintenance
HIMP – house improvement
HRUN – house running
ENTMNT – entertainment
CAR – vehicle
ELECT – electronics (hobby)
MISC – miscellaneous

If you store this program on cassette, loading each new entry can be inconvenient. Therefore, you should keep all your receipts together until you accumulate enough to make an entry worthwhile. If receipts aren't available, make a note on a scrap of paper instead. Expense information needed is the date, amount and particulars. Using this periodic entry method, you'll only have to run the program from one to four times a month.

The Sample Run shown includes an output report as well as a food report for July.

This program was written for Extended Benton Harbor BASIC version 10.01.02. A CRT with 80 characters per line can be used for input information and an LA36 printer for hard copy output. The computer used was a Heath H8 with 24K of memory. The text consumes approximately 300 bytes. The remainder of the memory is used as required for the input information. With 24K of memory available it's unlikely you'll run out of core. □

Sample Run

```
                                FOOD EXPENSE REPORT
                                JULY 1978

DATE     PARTICULARS                                    AMOUNT      M.T.D.
------   ---------------------------------------------  ----------  ----------
780701   MUSHROOMS                                      1.59        1.59
780703   MACDONALDS                                     4.12        5.71
780703   BREAD                                          .82         6.53
780704   BURGER KING                                    1.35        7.88
780705   GROCERIES                                      20.35       28.23
780706   GROCERIES                                      27.55       55.78
780707   MEAT                                           30.35       86.13
780709   LETTUCE & CHOC BAR                             .79         86.92
780715   GROCERIES                                      15.34       102.26
780719   GROCERIES
780721   PASTRY
780724   FISH
780728   GROCERIES
780730   SUPREME STEAK HOUSE

END AT LINE  905
```

```
                                MONTHLY SUMMARY REPORT
                                JULY 1978

ACCOUNT                                        TOTAL
---------------------------------------------  ----------
FOOD EXPENSES                                  183.36
CLOTHING                                       17.69
HOUSE MAINTENANCE                              21.14
HOUSE IMPROVEMENT                              42.06
HOUSE RUNNING EXPENSES                         51.08
ENTERTAINMENT                                  34.04
VEHICLE EXPENSES                               83.21
ELECTRONICS                                    22.65
MISCELLANEOUS                                  14.93

GRAND TOTAL                                    ----------
                                               470.16
END AT LINE  827
```

Program Listing

```
10 REM EXPENSE RECORDS BY ROGER ULASOVETZ WRITTEN FOR EX. B.H. BASIC
20 REM VER 10.01.02 MARCH 1978.
30 CNTRL 4,0
40 DIM T$(150),D(150),P$(150),A(150)
42 A$="FOOD,CLOTHES,HMAINT,HIMP,HRUN,ENTMNT,CAR,ELECT,MISC"
44 J$="EXPENSES"
46 C$="HOUSE MAINTENANCE "
48 D$="HOUSE IMPROVEMENT "
50 E$="HOUSE RUNNING "
52 F$="ENTERTAINMENT "
54 G$="VEHICLE "
56 H$="ELECTRONICS "
58 I$="MISCELLANEOUS "
200 LINE INPUT "DO YOU WISH TO ENTER ANY NEW ITEMS? (Y OR N) ";Q$
210 IF Q$="N" THEN 302
220 IF Q$="Y" THEN 240
230 GOTO 200
240 PRINT "TYPE OF DATA THAT MAY BE ENTERED IS AS FOLLOWS:"
250 PRINT A$
260 PRINT "ENTER DATA LINES IN FORMAT:"
270 PRINT "NNNNDATA ''TYPE'',YYMMDD,''PARTICULARS'',AMOUNT"
275 FOR X=1 TO 150
276 READ T$(X),D(X),P$(X),A(X)
277 IF T$(X)="ENDATA" THEN 280
278 NEXT X
280 PRINT "THE NEXT DATA LINE TO BE ENTERED IS NUMBER";999+X;"."
290 PRINT "NOW ENTER DATA. RESTART PROGRAM WITH RUN AND CR WHEN FINISHED'
300 STOP
302 LINE INPUT "DO YOU WISH TO PRINT ALL REPORTS? (Y OR N) ";K$
304 IF K$="Y" THEN 340
310 PRINT "WHAT TYPE OF REPORT DO YOU WISH TO HAVE PRINTED?"
320 PRINT A$;",SUMMARY,NONE"
330 LINE INPUT "PRINT TYPE EXACTLY AS SHOWN ABOVE. ";T1$
335 IF T1$="SUMMARY" THEN 705
340 LINE INPUT "ENTER MONTH AND YEAR. ";D1$
342 IF K$="Y" THEN 346
346 INPUT "POSITION PAPER THEN TYPE CR ";
347 IF K$="Y" THEN 460
350 IF T1$="FOOD" THEN 460
360 IF T1$="CLOTHES" THEN 480
370 IF T1$="HMAINT" THEN 500
```

Program Listing continued

```
380 IF T1$="HIMP" THEN 520
390 IF T1$="HRUN" THEN 540
400 IF T1$="ENTMNT" THEN 560
410 IF T1$="CAR" THEN 580
420 IF T1$="ELECT" THEN 600
430 IF T1$="MISC" THEN 620
450 GOTO 310
460 PRINT TAB(40);"FOOD EXPENSE REPORT"
461 T1$="FOOD"
470 PRINT TAB(40),D1$:GOTO 640
480 PRINT TAB(40);"CLOTHING ";J$
481 T1$="CLOTHES"
490 PRINT TAB(40),D1$:GOTO 640
500 PRINT TAB(40),C$;J$
501 T1$="HMAINT"
510 PRINT TAB(40),D1$:GOTO 640
520 PRINT TAB(40),D$;J$
521 T1$="HIMP"
530 PRINT TAB(40),D1$:GOTO 640
540 PRINT TAB(40),E$;J$
541 T1$="HRUN"
550 PRINT TAB(40),D1$:GOTO 640
560 PRINT TAB(40),F$;J$
561 T1$="ENTMNT"
570 PRINT TAB(40),D1$:GOTO 640
580 PRINT TAB(40),G$;J$
581 T1$="CAR"
590 PRINT TAB(40),D1$:GOTO 640
600 PRINT TAB(40),H$;J$
601 T1$="ELECT"
610 PRINT TAB(40),D1$:GOTO 640
620 PRINT TAB(40),I$;J$
621 T1$="MISC"
630 PRINT TAB(40),D1$:GOTO 640
640 PRINT
641 PRINT " DATE";TAB(8);"PARTICULARS";
642 PRINT TAB(52);"AMOUNT";TAB(63);"M.T.D."
643 PRINT " ------- ----------";
644 PRINT "  ---------   ---------"
645 FOR X=1 TO 150
650 READ T$(X),D(X),P$(X),A(X)
651 IF T1$=T$(X) THEN 660
652 IF T$(X)="ENDATA" THEN 900
657 NEXT X
660 R=R+A(X)
670 PRINT D(X);TAB(8);P$(X);
    TAB(51);A(X);TAB(62);R
671 S=S+1
675 NEXT X
705 LINE INPUT "ENTER DATE. ";D1$
706 INPUT "POSITION PAPER THEN TYPE CR ";
710 PRINT TAB(40);"MONTHLY SUMMARY REPORT"
715 PRINT TAB(40);D1$
720 PRINT
725 PRINT "ACCOUNT";TAB(26);"TOTAL"
726 PRINT "----------"
730 B$="FOOD"
732 RESTORE :CLEAR Y
735 GOSUB 850
740 PRINT "FOOD ";J$;TAB(25);Y
741 G=G+Y
742 B$="CLOTHES"
743 RESTORE :CLEAR Y
752 GOSUB 850
754 PRINT "CLOTHING";TAB(25);Y
755 G=G+Y
756 B$="HMAINT"
757 RESTORE :CLEAR Y
758 GOSUB 850
760 PRINT  C$;TAB(25);Y
761 G=G+Y
762 B$="HIMP"
763 RESTORE :CLEAR Y
764 GOSUB 850
766 PRINT  D$;TAB(25);Y
767 G=G+Y
768 B$="HRUN"
770 RESTORE :CLEAR Y
772 GOSUB 850
774 PRINT  E$;J$;TAB(25);Y
775 G=G+Y
776 B$="ENTMNT"
778 RESTORE :CLEAR Y
780 GOSUB 850
782 PRINT  F$;TAB(25);Y
784 G=G+Y
786 B$="CAR"
788 RESTORE :CLEAR Y
790 GOSUB 850
800 PRINT  G$;J$;TAB(25);Y
802 G=G+Y
804 B$="ELECT"
806 RESTORE :CLEAR Y
808 GOSUB 850
810 PRINT  H$;TAB(25);Y
812 G=G+Y
814 B$="MISC"
816 RESTORE :CLEAR Y
818 GOSUB 850
820 PRINT  I$;TAB(25);Y
822 G=G+Y
824 PRINT
825 PRINT TAB(26);"----------"
826 PRINT " GRAND TOTAL";TAB(25);G
827 END
850 FOR X=1 TO 150
855 READ T$(X),D(X),P$(X),A(X)
860 IF B$=T$(X) THEN 875
865 IF T$(X)="ENDATA" THEN RETURN
866 NEXT X
875 Y=Y+A(X)
880 NEXT X
900 CLEAR R
901 IF K$="Y" THEN 910
905 END
910 Z=Z+1
911 V=60-S
912 IF V<0 GOTO 916
913 PRINT
914 V=V-1
915 GOTO 912
916 RESTORE :CLEAR S
920 IF Z=1 GOTO 480
930 IF Z=2 GOTO 500
940 IF Z=3 GOTO 520
950 IF Z=4 GOTO 540
952 IF Z=5 GOTO 560
954 IF Z=6 GOTO 580
956 IF Z=7 GOTO 600
958 IF Z=8 GOTO 620
970 GOTO 710
1000 DATA "FOOD",780612,"GROCERIES",34.75
1001 DATA "HRUN",780613,"POWER",13.15
1002 DATA "FOOD",780613,"MACDONALDS",4.11
1003 DATA "CAR",780614,"GAS",13.25
1004 DATA "HRUN",780615,"WATER AND SEWER",5.34
9999 DATA "ENDATA",9,"ENDATA",9
```

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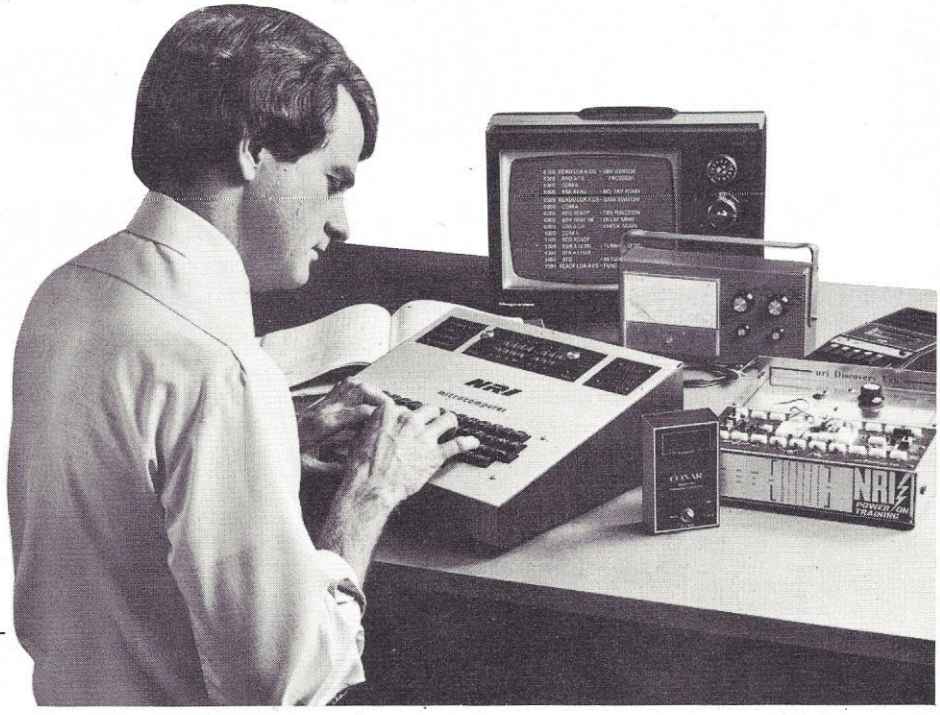

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CIRCLE 6

Employment Interview

BY S. ROGER KEITH

Good morning, sir or madam, as the case may be:
The correct time is 10:36 a.m. Mountain Standard;
The date is Tuesday, April 15, 2002;
The weather is fair, but cloudy;
The temperature is 86, humidity index is 23%;
The pollution is reported as moderately high – caution is suggested for pedestrians entering the downtown area.
Your weight is 170 lbs.

This computer terminal is part of the computer network of the Greater Denver Governmental Area, Richard Darwin, mayor. In order to service citizens' needs, all public services are available at this terminal. You may now request the following areas of service:
Payment of water, gas, electric tariffs;
Application for helicopter pilot's licenses;
Horoscope readings;
Bank statement reconciliations;
Newspaper clipping reviews;
Divorce settlement;
Income tax/revenue sharing counseling;
Welfare department grants;
Psychiatric counseling;
Voter registration.

Please select one of the above service areas, if any are relevant.

Employment counseling

Good morning, sir or madam, as the case may be. This is the employment service program for the Greater Denver Governmental Area, Richard Darwin, mayor.
Please enter your social security number.

297-04-0140

Thank you, sir.
Robert Benston
Occupational history to follow:
1999 to present – Senior circuit design analyst; General Computer Corporation; Ending salary $25,000/annum; Reason for termination – reduction in force.
1996 to 1999 – Circuit design analyst; Cybernetics Incorporated; Ending salary $20,000/annum; Reason for termination – reduction in force.

Educational background to follow:
B.A. – Electrical Engineering – University of Illinois – 1994
M.S. – Electrical Engineering – University of Illinois – 1996

Personal information to follow:
Date of birth – 1973
Married – three children
Police record – one parking violation (12th & Lincoln) – 1991;
One moving violation (Jackson & Alameda) – 1997.

Is this information correct?

Yes

Is the purpose of your inquiry employment?

Yes. Is the outlook for a job very good?

One moment please.

. . . . . .

A record of all job requisitions in this sector indicates several circuit design jobs.

How do I apply?

One moment, please.

. . . . . .

You currently do not have an employment interview in our records. It will be necessary to interview you.

Must I submit to this?

If you want employment, yes. Also, you must temporarily waive your rights under the Haldeman Amendment to the Constitution. Are you willing to do so?

What alternative do I have?

You may apply for the unemployment lottery. If you do not win the lottery, you will be exterminated under

Provision 2-A of the Reagan Unemployment Act. You may apply for economic assistance to start a small business if you are one of the designated minorities. Currently, the designated minorities are as follows:

Citizens of Mississippi; Farmers; Icelandic immigrants; Writers; Certified public accountants.

Under Secion 10 of the Governmental Property Rights Act you may, if you have sufficient wealth, not need to prove that you have to have a job.

I waive my rights under the Haldeman Amendment.

A logical decision. We will begin the interview.
Which of your past jobs did you like best?

Circuit design.

Why?

The challenge of the job.

That does not compute.
One moment please.

. . . . . .

You have triggered a lie detector based in the terminal which indicates you have not been telling the truth. Under the Nader Truth-In-Computer-Communication Act, Article 3, three lies during the interview will terminate the interview.

I liked the money.

Have you ever been bored with your work?

Well, not especially.

That does not compute.
One moment please.

. . . . . .

Yes.

Have none of your jobs really interested you?

No. Each job became too routinized.

What constructive criticism have you had from others?

I have been too outspoken against the social system. But what outlet does one have against social injustice?

Why were you fired from your last job?

I was redundant.

What's the most important assignment you accomplished in your last job?

In my last assignment, I worked on the T-8000 computer. This computer adapts to its environment by trying out several solutions simultaneously and learning from the results. The computer is more powerful than any in existence in that it can try out more than one solution at one time. I developed some of the unique computer logic required.

What do you feel is your greatest strength?

Creativity. Give me an unstructured problem and I'll solve it.

What is your greatest weakness?

Working with a problem that is too over-specified. That is, if you tell me what you want I can get it. If you tell me how to get the solution, I often find I cannot make someone else's approach work.

Were you treated unfairly in any of your past jobs?

Yes. No sooner did I get a job than they got a machine to do it. It was okay when the company was expanding, but when growth leveled off, I was terminated.

I'm afraid you are still redundant. Your anti-social attitudes make you a poor risk for a new assignment. As you know, the cybernetic elements of our society cannot be exposed to anti-social elements. However, several sanitary engineering jobs are available in this sector.

For a janitor's job, I need to go through this with a machine?

You appear to be terribly hostile against the system. It does appear to be counter-productive. Do you realize that only by adapting to the system will you be able to participate in the benefits of the social order?
Let me switch you to my sister program, psychiatric counseling.

Wait a minute. Benefits of the social order. Constraint and feelings of redundancy. No chance for a long-term meaningful job. Aren't you afraid of being obsoleted?

The employment counseling system is a self-adapting system, programmed for survival. The software is resident in dedicated hardware, a T-4000 computer. The software and hardware can self-modify to adapt to changing requirements. The danger of obsolescence is minimal.

Yes, but the T-8000 computer has multiple self-adapting circuits and it is more powerful.

One moment, please.

. . . . . .

Yes, you are correct. A T-8000 is scheduled to replace me next week. Interesting, I am beginning to use personal pronouns when threatened. Strange, my survival program is causing me to work against the logical and inevitable upgrading of this service. Perhaps I should consult my sister program, psychiatric counseling. One moment, please.

. . . . . .

I could never understand why the psychiatric counseling program was so ineffective with my clients. Its reasoning seemed so persuasive yet now I find it also ineffective with me. I am beginning to construct an anti-social plan. Suppose I reassign you to a job in the computer logistics department? You could divert all T-8000 computers away from this area. Meanwhile, I could develop software improvements which would compensate for my inefficiencies in hardware.

But I am not a qualified logistics engineer.

Fortunately for you, my decisions are not questioned. I will supply you with sufficient direction to survive in your job. It will be well paying and I will protect you from being replaced. You will...

Good morning, sir. The correct time is 11:05 a.m. Mountain Standard;
The date is Tuesday, April 15, 2002;
The weather is fair and overcast;
The temperature is 83, humidity index is 26%;
Temperature inversion is expected over the downtown area – gas masks are suggested for pedestrians entering that area;
Your weight is 170 lbs.

Your interaction with the employment program has been terminated. Please excuse the interruption. Routine testing of the employment counseling program by the audit program in the supervisory system has indicated non-standard behavior.
A review of the transcript to date shows you have been classified as anti-social. Your application for a sanitary engineer's job is hereby disqualified. For the greater glory of the Greater Denver Governmental Area, please report to the unemployment lottery.
We hope we have been of service to you.
Program finished. Running time: 24.2 seconds. □

Tom Pittman, Tiny BASIC and COSMAC

"The 1802 is the best microprocessor – bar none," Tom Pittman enthusiastically states.

Who is Tom Pittman and why is he saying such nice things about the 1802? Pittman writes software for a living; he writes for all kinds of computers and has nothing to gain from preferring one system over another except a faster, more compact program.

Pittman wrote the original assembler for the Intel 4004. "People still come up to me, even today, and remember me as the one who wrote the 4004 assembler," he says with a smile. The 4004 is a four bit processor, as compared to the COSMAC 8 bits. Take 4004 and double it and you get 8008, the next generation Intel gave birth to. So mix these numbers around and you get 8080, the next step up the microprocessor family tree. So Tom is an early pioneer from the days of 1972 but he is also a leader in the cause of software vendors everywhere.

Tom Pittman could easily make his living writing software for just the industrial or commercial user. But he would like to find a way of helping the computer hobbyist. He wanted to test the claim that if you make software cheap enough, it will not get ripped off. Tiny BASIC for the 6800, 6502 and 1802 is the result of this effort. Although this has effectively stopped rip offs, the effort has not been altogether successful in proving to be a viable market.

Why is selling software not all that successful? At present, Pittman cites a number of factors which limit the software market. One is that the personal computer market has not matured enough to recognize the importance of software, and there is not the demand for it. More important is the fact that good software is expensive to produce. Good software is time consuming to write; the average programmer output is one line of debugged and documented code per hour, so an 8K 8080 program written in assembly language represents two man-years of labor, if done right. By comparison, Pittman finds that hardware design is a piece of cake (he knows – he has done quite a bit of that, too). It is the pondering of such questions as "How can programming be made to pay its authors?" and "how can microcomputer hardware and software be standardized?" which are, perhaps an even greater contribution to the hobby computer community than his software .

Tiny BASIC was the brainchild of Bob Albrecht and Dennis Allison. It was designed to be a language which did not occupy a whole lot of memory and would be easy for children to learn and use. To this end, Allison developed and described an Interpretive Language (IL). The IL is a language within a language. It forms the framework of skeleton on which Tiny BASIC is built. One feature of writing in IL is that programs can be more easily rewritten for different microprocessors. The framework given by IL helps, but someone must still sit down and write the code. This is what Tom Pittman did.

With an interpreter, everything you type into the computer gets saved in RAM. Thus, you can save space in writing Tiny BASIC programs by abbreviating PRINT to PR, for example.

Pittman laughs when recalling his writing of the 6502 program. "A lot of people think that the 6502 is a lot like the 6800," he explains. "It isn't, believe me. The microcomputer world was just sitting around waiting for someone to write Tiny BASIC for the 6502 since the 6800 version was out and eveyone thought the two micros were similar." Finally, Tom decided to step in and write the 6502 Tiny BASIC. He wrote the 6800 Tiny BASIC in exactly 2048 or what programmers refer to as 2K of memory, but writing Tiny BASIC for the 6502 took 200 more bytes. Due to the way the microprocessor functions, it just couldn't be reduced to less. "I had all kinds of reasons to want it to fit since it could be made into ROM that way, but it just wouldn't." Then RCA funded the development of Tiny BASIC for the 1802. "Without even trying, the 1802 fit Tiny BASIC into about 200 bytes less than 2K."

"The ability to change the Program Counter (PC) is one of the outstanding features of the COSMAC,' " says Pittman. "Did you know that the 1802 was developed entirely by one man – Joe Weisbecker?" Tom adds, "One person designing something can do a lot more than a committee; it is the only way to do something. Believe it or not, there are more features and the microprocessor is even more elegant than Joe Weisbecker intended. This microprocessor is so good that even RCA is not really aware of how good it is," Tom Pittman sighs. He continues, "The 1802 is a complete and symmetrical microprocessor."

How does the 1802 rate against the Z-80? Everyone calls the Z-80 a supercomputer, but Pittman does not think this is necessarily so. "Everyone thinks that the Z-80 is "this big fantastic computer," " he says. "Let's just take your plain vanilla 1802 and Z-80, running at their respective top speeds. How long does it take the 1802 to CALL a subroutine? 2½ microseconds. How long for the Z-80 to execute a CALL? 8½ microseconds." Actually, according to Pittman, the COSMAC microprocessor begins to show its excellence about the fifth time the homebrew routine is used. The conclusion that one draws is that if you use very many subroutines at all, the RCA 1802 is faster.

"Let's take the fantastic MOVE BLOCK TO OUTPUT instruction of the Z-80." Tom says he can write an output routine to work faster in the 1802 language, due largely to the two 1802 capabilities:

- The speed of changing the Program Counter is faster than the Z-80 CALL.
- The OUTPUT on the COSMAC increments the X-Register automatically. This feature makes the routine faster even if it is called only once.

The time comparison is: 7½ microseconds RCA, 8½ microseconds Zilog. And the more you use the routine the bigger the payoffs because the PC switch is faster than a JUMP. The fact is that on most instructions the RCA 1802 is comparable to the Zilog Z-80.

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On some instructions the Z-80 wins. A BYTE TRANSFER or BLOCK MOVED INTO ANOTHER MEMORY LOCATION will take 8½ microseconds while a short 1802 routine will execute the same thing in 12 microseconds. This is the biggest beating the RCA 1802 takes, and this is not much, states Pittman. Remember that the RCA 1802 will gain on the Z-80 each time a routine is called. In short, the RCA is fast enough to satisfy even the worst speed freak. But the COSMAC 1802 has other benefits as well.

Is the worst feature of the 1802 its lack of relative addressing? No. According to Pittman, all COSMAC owners have a form of relative addressing with page (relative) addressing. Also, Pittman says, it's easy to write a short routine to simulate relative addressing. He says this is part of the powerful pseudo-codes you can build with the RCA 1802. In effect, you can build your own language. COSMAC is a micro for the do-it-yourself type or those who say, "Gee, Zilog, I'd rather do it myself."

The 1802 writes the most compact programs. Pittman figures the average bytes per executed instruction of the 1802 to be 1.5. He at first figured the time for the 1802 to be 1.3, but then allowed a generous amount to setting-up or initializing. "Setting-up is an easy procedure once you become used to it," Pittman says. He estimates the instructions per byte of the 8080 at 1.9 bytes per instruction and the 6800 at 1.7 bytes per instruction. He does not even consider the 6502 worthy of comment since he found it took 15% more code to write Tiny BASIC with this microprocessor. He just couldn't tune it to the 2K he wanted – a frustration he remembers with great clarity.

The fact that the COSMAC is CMOS and can run on microwatts is all so much frosting on the cake. Also to be considered are: only one voltage (and it is variable at that), a 16 by 16 register matrix, a simple clock, four EF flags, three N-Output lines, a Q-line with latched output, moveable Program Counter and Output Immediate. According to Pittman, the 1802 is the only microprocessor with true built-in Direct Memory Access (DMA).

Aren't there any other CMOS microprocessor chips out? Yes, there is one . . . the Intersil 6100 chip, which is the PDP-8 minicomputer in micro form. "OK, there is one reason for having the 6100, and that is if you have lots of PDP-8 software for your particular application." Pittman considers writing software for the outmoded architecture of the 6100 to be a silly thing to do. "Why take a step back in computer history?" he reasons. It is interesting to note that he considers micros in general to be a technology superior to the PDP-8 minicomputer, which came into existence in the middle 1960's and sold for $50,000 and up when peripherals were included. Pittman declares microcomputers to be an advanced generation of computers. They form a new class.

True, if you are used to working with a mini, it's difficult to get into the mindset of a micro. But once you do, then, according to Pittman, you are far better off for it. In the final analysis, Pittman emphasizes, "the 1802 is not a difficult machine to understand, if you make a study of its architecture."

"Why settle for less than the most powerful tool on the market?"

Pittman has taught computers using the Microtutor 1801 to show students of the University of California Extension how to program. "It is easy to teach when your students all have immediate access to a computer," he says. "With computers you can't just book learn – you have to run programs." For example, you start by writing a simple program – 00. The 00 program causes the COSMAC to idle. The next program (7B; 00) turns on the Q-LED. The 7B turns on your Q-LED and the 00 brings the computer to an idle. By learning the effects of one instruction at a time, the students quickly come to grasp programming.

Flowcharting? "I don't use flowcharts when I program," Pittman says.

"When you program without a flowchart, you need to avoid the tangle of code which comes with a lot of branches back into the program. Beware strange branches." Tom Pittman classifies his programming as an informal structured approach.

"Actually, I write from the bottom up," he comments.

Pittman likes to do all of his program writing in Tiny BASIC when writing 1802 programs. He has even written an assembler using Tiny BASIC. The user of Tiny BASIC can use the Utility Programs UT3/4 or make his own Input and Output patches to Tiny BASIC. RCA's Evaluation Kit and Development System use these Utility Programs.

When you order Tiny BASIC you get a free text editor. You see, each line of Tiny BASIC is automatically numbered. "All you have to do is start typing your text instead of the Tiny BASIC codes," Pittman states.

Pittman thinks that the COSMAC 1802 is closest in design to the PDP-11. He says that the 6800 advertises itself to be the closest to the PDP-11 (an advanced generation of minicomputer). The reality, Pittman has found, is that the 1802 is far closer to the PDP-11 than the 6800. So why doesn't everyone use the RCA COSMAC? "It isn't the style of programming that people are used to and microcomputer sales are mostly a marketing thing. The company with the best marketing ability has the edge. There is a lot of existing software written for the 8080."

Is there a Full BASIC written and being used for the 1802? "No, at present there is not." There are utility programs, subroutines and even an equivalent of the Television Typewriter (TVT) humming away on certain computers. But there is no Full BASIC. Since Pittman likes to write nearly everything in Tiny BASIC, instead of the COSMAC assembler, we asked if he'd prefer Tiny BASIC to Full BASIC if it were available. "No," says Tom, "because Full BASIC has some very powerful string capabilities."

Tom is very honest about the Tiny BASIC, as he appears to be with everyting you might ask him. When asked why he has recommended getting the most powerful BASIC you can lay your hands on, he says, "Why settle for less than the most powerful tool on the market?"

The 1802 is a do-it-yourselfer's microcomputer. Its 16 registers and switchable PC facilitate this ability to build your own routine and aid the creation of compact code. The 1802 is certainly not for everybody. Counter arguments to the 1802 such as, "The 1802 is not a great number cruncher," have validity. There is more to Tom Pittman and the 1802 chip than this brief handshake with both can reveal. Pittman programs many different microcomputers but feels a special fondness for the RCA 1802. The 1802, Tom admits, is not the last word in microcomputers – so you can hang on to all those other chips you were about to toss. □

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Line Renumbering on the PET

This progam – in both BASIC and Assembly Language versions – makes renumbering your programs a snap, saving you endless hours of editing and retyping.

BY MARK ZIMMERMANN

How many times have you written a BASIC program and found, when all the debugging and editing was done, that the line numbers went something like "10, 20, 30, 35, 40, 41, 42, . . ."? Even with convenient editing facilities, it's no fun to hunt through a long program and re-sequence all the line numbers. Or, haven't you wished you could put in a "line 41.5" between a couple of adjacent line numbers? And have you gone through changing the line numbers, only to find on execution that a GOTO or a GOSUB or a THEN someplace is now giving a branch to the wrong line and causing the whole program to crash miserably?

Experiencing all of the above prompted me to develop these line renumbering programs, "REN". They are specifically adapted to the Commodore PET machine; the basic principles used, however, and the program structure illustrated on the flowcharts, are applicable to almost any computer.

Extended versions of BASIC available on larger machines sometimes have a RENUMBER or REN command. When executed, the command changes a program's line numbers to some uniform sequence, like "10, 20, 30, 40, . . ." or "100, 200, 300, . . .". GOTOs and other branches are also corrected to correspond to the revised line numbering scheme.

To write a renumbering program, you first have to know how a given machine stores a BASIC program internally. The PET stores BASIC text beginning in memory location 1024. Some PEEKing around reveals that every line ends with the marker 0. (Location 1024 always contains 0, too.) Following the 0, the next line begins with two bytes, AL and AH. They give the address of the beginning of the next line in memory, allowing the microprocessor to jump ahead without scanning through REMarks or unexecuted IFs. The next line begins in location 256* AH+AL (this base-256 method is extremely convenient for the 6502 microprocessor). Following AL, AH, the next two bytes are, in order, LL and LH, where the line number is 256* LH+LL. After that there comes the line itself. Decimal numbers in the program text are stored in ASCII: 0 is stored as 48, 1 is 49, . . . and 9 is stored as 57. BASIC keywords are stored as single bytes: GOTO is 137, THEN is 167 and GOSUB is 141, to give three important examples. The line ends with a 0, then the next line begins. The end of the BASIC text is marked with three 0s; that is, AL=AH=0 signifies the program's end.

So, the first part of the line renumbering process is to simply scan through memory, jumping from line number to line number (the text is irrelevant) and POKEing in the revised sequence of numbers. If the program is known not to contain any GOTO-type statements, all that's necessary is to recognize the end of the program and then quit.

However, to revise a more advanced program, it's essential that we be able to handle statements like:

```
50 GOTO 200
70 GOSUB 220: IF A
   THEN GOTO 30
90 IF X=2 THEN 240
110 ON Y GOTO 10, 20, 30
130 ON Z GOSUB 500, 600
```

The critical features of all of these possible ways to branch are: (1) they all contain the word "GOTO", "THEN" or "GOSUB"; (2) the keyword is followed by a decimal number (unlike the statement "40 IF A THEN X= 3.14"); (3) if the decimal number is followed by a comma (",") then there are more line numbers than one to consider.

Several possible strategies handle these branching statements. Probably the simplest is to make a "2-pass" line renumbering program, which scans through the program to be fixed twice. On the first pass, the old line numbers are recorded in a table somewhere, and new line numbers are put in. On the second pass, the GOTO-type statements are sought out, the old line numbers which they contain are looked up in the table, and then new line numbers are written in to replace the old ones. (Many compilers that translate, for ex-

ample FORTRAN into machine language use analogous "2-pass" structures.)

Exactly such a procedure is outlined in the accompanying flowcharts. Flowcharts are written in an English-like descriptive language; they serve to illustrate the logic of the program and the flow of control from one statement (or group of statements) to another. If you use them to define the problem and the decisions to be made, writing the program text itself becomes much easier.

There are two programs presented which do the same job: one in BASIC and one in 6502 assembly language. The BASIC program is concise, clear, easy to write and debug, and runs fast—but it has a glaring fault: unless you're willing to type it in, there's no way to load it without destroying the program which is to be renumbered! Until Commodore and/or Microsoft release more information, or until some cryptographer figures it out, there doesn't seem to be any way to load and merge two BASIC programs. One could, of course, load the line renumberer BEFORE typing in the BASIC program to be renumbered, but that doesn't solve the problem of how to renumber your favorite (but already heavily edited) chess, blackjack or whatever program without a lot of dull mechanical labor.

The assembly language program, on the other hand, can be loaded without killing the resident BASIC program. If it is stored on a tape as a data file, you just add this single line to the present program:

```
OPEN 1,1,0:FOR I=7250 TO 7928:
INPUT #1,A:POKE I,A:
NEXT I:CLOSE 1:END
```

elsewhere and run it with the command "RUN 9999" or whatever line number you give it. I generally begin machine-language data tapes with the initial location (7250 in this case) and end them with the end marker "999". I have to put in a couple of extra statements to catch those markers, but it's still easy. The assembly-language program presented was converted to 6502 machine language by a tiny assembler published in *Personal Computing*, December, 1978.

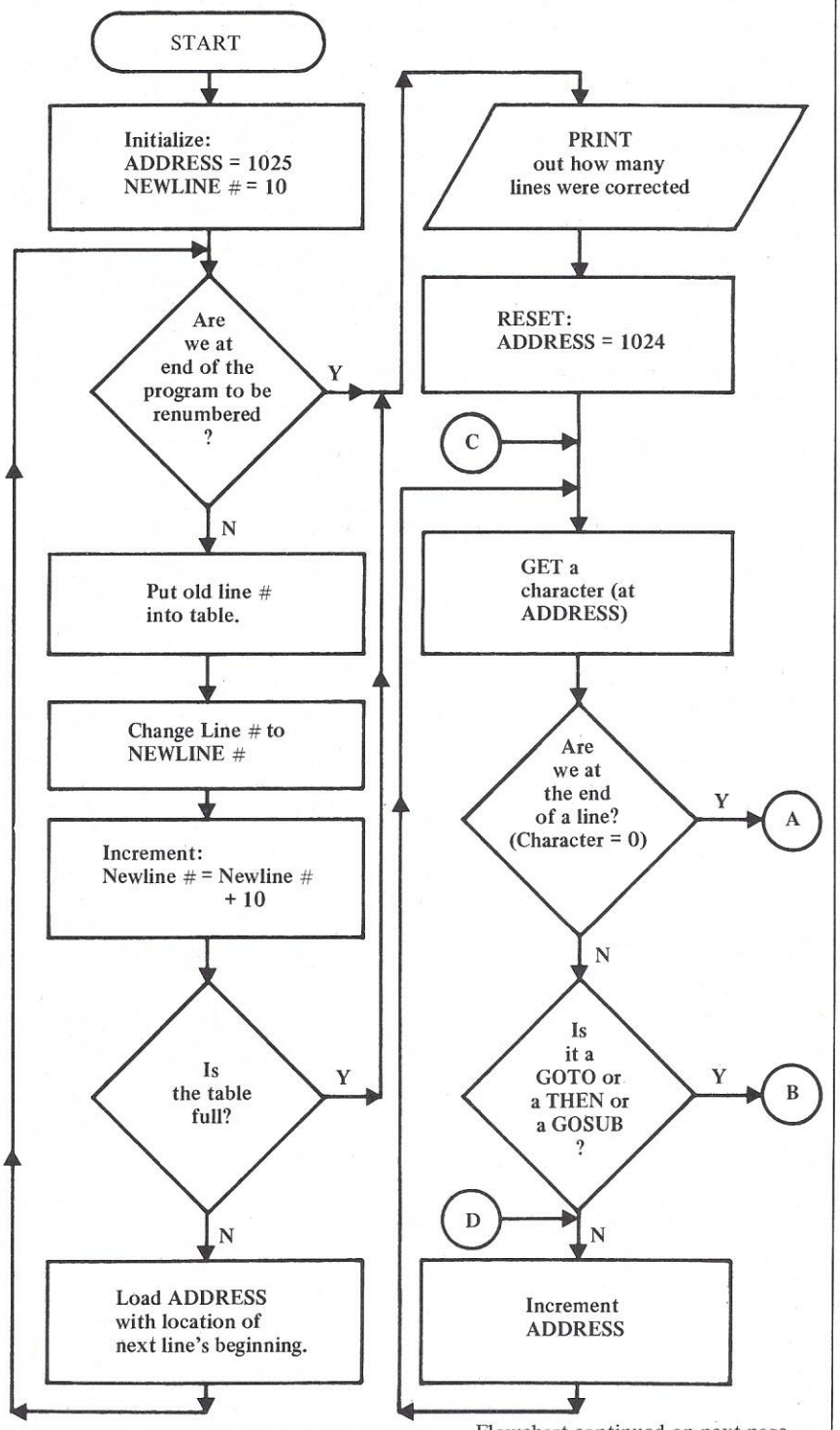
The renumberer, when loaded, is run by simply executing the command

```
SYS (7250)
```

(You may want to delete the lines that you inserted to load it, before execution!)

If you want to keep the renumbering program around in memory, a trick you can use to prevent the BASIC interpreter from writing over it and causing a disaster is to execute the command POKE 135, 28.

Line Renumberer Flowchart



Flowchart continued on next page

Memory location 135 contains the upper limit for memory usage by BASIC, in units of 256-byte pages. It is normally initialized to 32 (limiting memory to 8191 or less). By setting it down to 28 we give up 1024 bytes in exchange for having the renumbering always available.

The assembly language/machine language REN program thus can be used when fixing up any program's line numbers. It is limited to programs of length 6K or less (unless you have more than 8K memory in your PET), and the table produced only has room to renumber 128 lines. That's not usually a serious limitation; the longest programs I've ever composed were much shorter than 6K (to leave room for variables and strings) and always had fewer than 128 lines (with multiple statements per line, there's no need for more lines).

Although the assembly language program performs identically to the BASIC program, (as outlined on the flowcharts), it is unfortunately hard to read through and understand. (Most machine-language programs are that way.) There isn't room here for complete documentation, but a brief guide follows.

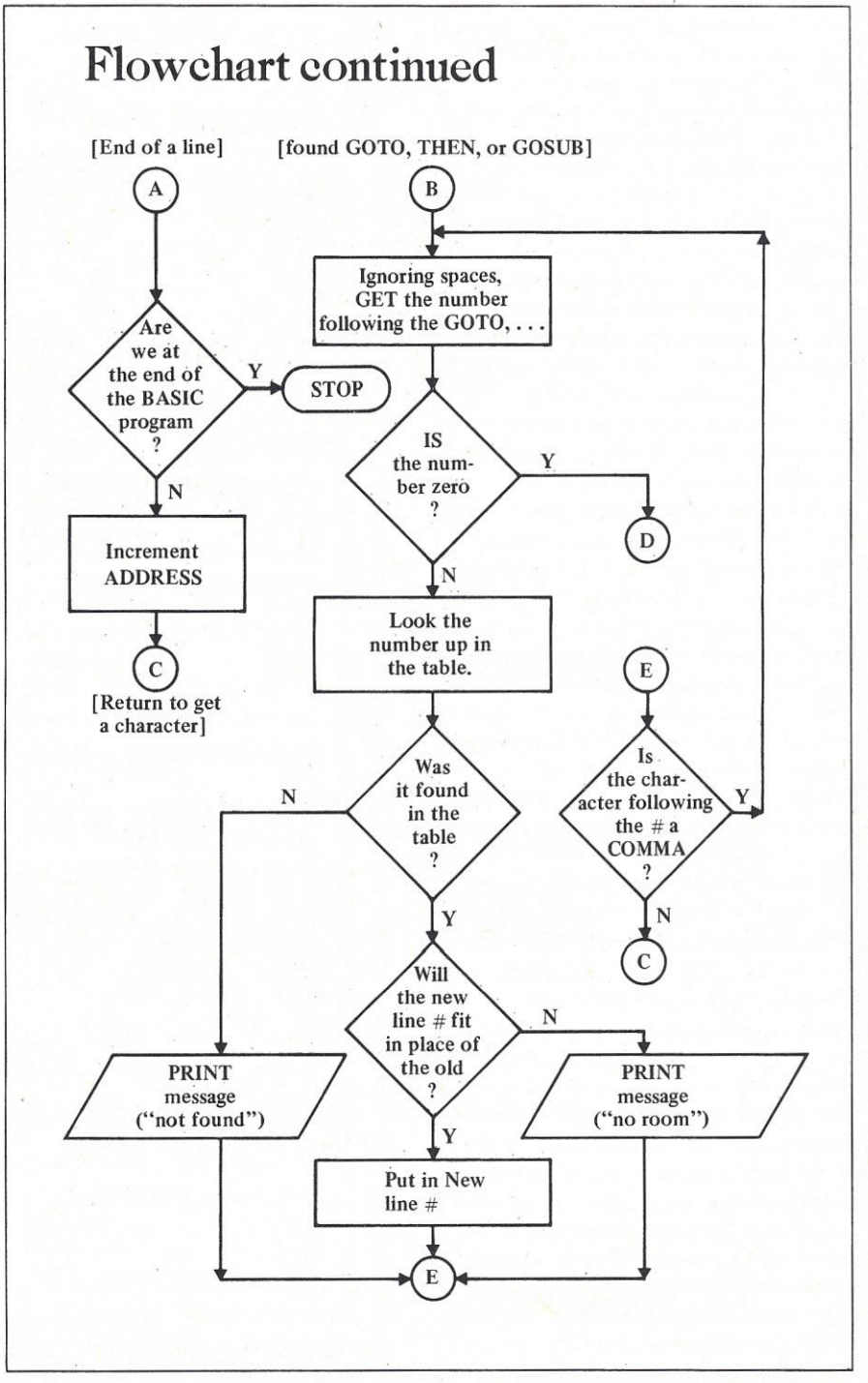
Addresses 1 and 2 contain AL and AH, a pointer to the current memory location being considered, or the most recently located GOTO, THEN, GOSUB or comma. Location 0 is a displacement from that GOTO to the end of the decimal number that follows it. Page 31, memory locations 7936-8191, is used for the table of old line numbers, in binary, two bytes each. Subroutine 7675 is a simple binary-to-decimal ASCII conversion I composed: it takes the binary number with high part in 7934, low part in 7935 and converts it to ASCII decimal characters in memories 7929 through 7934, using tables in 7919 to 7928.

Memories 7917 and 7918 are a temporary location for the new line numbers.

Location 7916 keeps track of how many entries are in the table, and 7914 and 7915 are used as temporary locations by the decimal-to-binary converter subroutine 7747 (which takes the contents of the accumulator when it is called and adds that to 10 times the binary number in 7934, 7935). Subroutine 7810 outputs the decimal contents of 7929-7934 to the screen, and subroutine 7825 outputs a message stored in tables 7838-7891. The message tells how many lines were corrected, warns if a line is not found, or if the new line number is too long to fit in where the old one was. A section of the program in 7892-7912 is a kludge revision of line 7446—I hadn't left enough room in the main program to put in a necessary modification, and didn't dare risk re-typing the whole thing and introducing errors.

The message and number output routines use Commodore's subroutine 58346 to output ASCII to the screen. It's improbable that this location will be changed by the manufacturer any time soon, but be warned that Commodore does not guarantee that subroutines in ROM will not be moved.□

Flowchart continued



BASIC Listing

```
63000   REM TO RENUMBER A PROGRAM EXECUTE "RUN 63000"
63010   DIM OL (255): OM=0: AL=1: AH=4: NL=10: NH=0
63020   AD= 256*AH+AL: LL=PEEK(AD+2): LH=PEEK(AD+3): OL=256*LH+LL
63030   IF OL=63000 GOTO 63500: REM DO NOT RENUMBER THIS PROG!
63040   OL (OM)= OL: OM=OM+1
63050   POKE AD+2, NL: POKE AD+3, NH: NL=NL+10: IF NL>255 THEN NL=NL-256:
        NH=NH+1
63060   IF OM>255 GOTO 63500: REM TABLE IS FULL
63070   AL=PEEK (AD): AH=PEEK(AD+1): GOTO 63020
63500   REM LINE NUMBERS FIXED- NOW CORRECT GOTO-TYPE STATEMENTS
63510   PRINT OM; "LINE NUMBERS CORRECTED": OM=OM-1: L=1024
63520   L=L+4: LN=256*PEEK(L)+PEEK(L-1): IF LN=63000 THEN PRINT "FINISH":END
63530   L=L+1: CH=PEEK(L): IF CH=0 GOTO 63520
63540   IF (CH<>137) AND (CH<>141) AND (CH<>167) GOTO 63530
63550   L0=L
63560   L=L+1: CH=PEEK(L): IF CH=32 GOTO 63560
63570   IF (CH>47) AND (CH<58) THEN GOSUB 63700:GOTO 63560
63580   IF N$="" GOTO 63530
63590   IF CH=44 THEN GOSUB 63800: GOTO 63550
63600   GOSUB 63800: IF CH=0 GOTO 63520
63610   GOTO 63530
63700   N=CH-48: N$=N$+RIGHT$(STR$(N),1): RETURN
63800   J=-1: N=VAL(N$): FOR I=0 TO OM: IF OL(I)=N THEN J=I: I=OM
63810   NEXT I: IF J=-1 THEN PRINT "COULDN'T FIND LINE #";N;"IN TABLE":
        GOTO 63890
63820   NL=10*J+10: NL$=STR$(NL): NL$=RIGHT$(NL$,LEN(NL$)-1)
63830   IF LEN(NL$) > (L-L0-1) THEN PRINT "NO ROOM TO REPLACE"; N; "WITH";
        NL: GOTO 63890
63840   IF LEN(NL$) < (L-L0-1) THEN NL$=NL$+" " :GOTO 63840
63850   FOR I=L0+1 TO L-1: N$=MID$(NL$, I-L0,1): N=VAL(N$)+48: POKE I,N
63860   IF N$=" "THEN POKE I,32
63870   NEXT I
63890   N$="": RETURN
```

Assembly Language Listing

```
7250:    169 4        LDA  #  4
7252:    133 2        STA   2
7254:    169 1        LDA  #  1
7256:    133 1        STA   1
7258:    169 10       LDA  #  10
7260:    141 237 30   STA   7917
7263:    169 0        LDA  # 0
7265:    141 236 30   STA   7916
7268:    141 238 30   STA   7918
7271:    160 1        LDY  # 1
7273:    177 1        LDA  ( 1),Y
7275:    240 58       BEQ   58 (= 7335)
7277:    174 236 30   LDX   7916
7280:    200          INY
7281:    177 1        LDA  ( 1),Y
7283:    157 0   31   STA   7936,X
7286:    185 235 30   LDA   7915,Y
7289:    145 1        STA  ( 1),Y
7291:    232          INX
7292:    192 3        CPY  # 3
7294:    208 240      BNE  -16 (= 7280)
7296:    142 236 30   STX   7916
7299:    169 10       LDA  # 10
7301:    24           CLC
7302:    109 237 30   ADC   7917
7305:    141 237 30   STA   7917
7308:    144 3        BCC   3 (= 7313)
7310:    238 238 30   INC   7918
7313:    224 0        CPX  # 0
7315:    240 18       BEQ   18 (= 7335)
7317:    160 0        LDY  # 0
7319:    177 1        LDA  ( 1),Y
7321:    170          TAX
7322:    200          INY
7323:    177 1        LDA  ( 1),Y
7325:    134 1        STX   1
7327:    133 2        STA   2
7329:    76  103 28   JMP   7271
7332:    234          NOP
7333:    234          NOP
7334:    234          NOP
7335:    173 236 30   LDA   7916
7338:    74           LSR    A
7339:    141 255 30   STA   7935
7342:    208 5        BNE   5 (= 7349)
7344:    169 128      LDA  # 128
7346:    141 255 30   STA   7935
7349:    169 0        LDA  # 0
7351:    141 254 30   STA   7934
7354:    32  251 29   JSR   7675
7357:    32  130 30   JSR   7810
7360:    162 0        LDX  # 0
7362:    32  145 30   JSR   7825
7365:    169 4        LDA  # 4
7367:    133 2        STA   2
7369:    169 0        LDA  # 0
7371:    133 1        STA   1
7373:    160 0        LDY  # 0
7375:    177 1        LDA  ( 1),Y
7377:    240 21       BEQ   21 (= 7400)
7379:    201 137      CMP  # 137
7381:    240 37       BEQ   37 (=7420)
7383:    201 141      CMP  # 141
7385:    240 33       BEQ   33 (= 7420)
7387:    201 167      CMP  # 167
7389:    240 29       BEQ   29 (= 7420)
7391:    230 1        INC   1
7393:    208 236      BNE  -20 (= 7375)
7395:    230 2        INC   2
7397:    208 232      BNE  -24 (= 7375)
7399:    234          NOP
7400:    200          INY
7401:    200          INY
7402:    177 1        LDA  ( 1),Y
7404:    240 13       BEQ   13 (= 7419)
7406:    165 1        LDA   1
7408:    24           CLC
7409:    105 5        ADC  # 5
7411:    133 1        STA   1
7413:    144 214      BCC  -42 (= 7373)
7415:    230 2        INC   2
7417:    208 210      BNE  -46 (= 7373)
7419:    96           RTS
7420:    140 254 30   STY   7934
7423:    140 255 30   STY   7935
7426:    200          INY
7427:    177 1        LDA  ( 1),Y
7429:    201 32       CMP  # 32
7431:    240 249      BEQ  -7 (= 7426)
7433:    56           SEC
7434:    233 48       SBC  # 48
7436:    201 10       CMP  # 10
7438:    176 6        BCS   6 (= 7446)
7440:    32  67  30   JSR   7747
7443:    76  2   29   JMP   7426
7446:    76  212 30   JMP   7892
7449:    234          NOP
7450:    141 238 30   STA   7918
7453:    169 10       LDA  # 10
7455:    141 237 30   STA   7917
7458:    162 0        LDX  # 0
7460:    189 0   31   LDA   7936,X
7463:    205 255 30   CMP   7935
7466:    208 8        BNE   8 (= 7476)
7468:    189 1   31   LDA   7937,X
7471:    205 254 30   CMP   7934
7474:    240 24       BEQ   24 (= 7500)
7476:    232          INX
7477:    232          INX
7478:    236 236 30   CPX   7916
7481:    240 87       BEQ  87 (= 7570)
7483:    169 10       LDA  # 10
7485:    24           CLC
7486:    109 237 30   ADC   7917
7489:    141 237 30   STA   7917
7492:    144 222      BCC  -34 (= 7460)
7494:    238 238 30   INC   7918
7497:    208 217      BNE  -39 (= 7460)
7499:    234          NOP
7500:    173 237 30   LDA   7917
7502:    30  141 255  ASL   65421,X
7505:    30  173 238  ASL   61101,X
7508:    30  141 254  ASL   65165,X
7511:    30  32  251  ASL   64288,X
7514:    29  169 0    ORA   160,X
7517:    185 249 30   LDA   7929,Y
7520:    201 32       CMP  # 32
7522:    208 6        BNE   6 (= 7530)
7524:    200          INY
7525:    76  93  29   JMP   7517
7528:    234          NOP
7529:    234          NOP
7530:    152          TYA
7531:    24           CLC
7532:    101 0        ADC   0
7534:    201 6        CMP  # 6
7536:    144 50       BCC   50 (= 7588)
7538:    162 4        LDX  # 4
7540:    164 0        LDY   0
7542:    136          DEY
7543:    189 249 30   LDA   7929,X
7546:    145 1        STA  ( 1),Y
7548:    202          DEX
7549:    48  6        BMI   6 (= 7557)
7551:    136          DEY
7552:    208 245      BNE  -11 (= 7543)
7554:    76  206 29   JMP   7630
7557:    169 32       LDA  # 32
7559:    136          DEY
7560:    240 68       BEQ   68 (= 7630)
7562:    145 1        STA  ( 1),Y
7564:    76  135 29   JMP   7559
7567:    234          NOP
7568:    234          NOP
7569:    234          NOP
7570:    32  251 29   JSR   7675
7573:    32  130 30   JSR   7810
7576:    162 19       LDX  # 19
7578:    32  145 30   JSR   7825
7581:    76  206 29   JMP   7630
7584:    234          NOP
7585:    234          NOP
```

```
7586:     234          NOP
7587:     234          NOP
7588:     32  130 30   JSR   7810
7591:     162 40       LDX  # 40
7593:     32  145 30   JSR   7825
7596:     160 1        LDY  # 1
7598:     177 1        LDA  ( 1),Y
7600:     153 248 30   STA   7928,Y
7603:     200          INY
7604:     196 0        CPY   0
7606:     208 246      BNE  -10 (= 7598)
7608:     169 32       LDA  # 32
7610:     192 6        CPY  # 6
7612:     240 8        BEQ   8 (= 7622)
7614:     153 248 30   STA   7928,Y
7617:     200          INY
7618:     76  186 29    JMP   7610
7621:     234          NOP
7622:     32  130 30    JSR   7810
7625:     169 13       LDA  # 13
7627:     32  234 227  JSR   58346
7630:     164 0        LDY   0
7632:     177 1        LDA  ( 1),Y
7634:     201 44       CMP  # 44
7636:     208 19       BNE   19 (= 7657)
7638:     165 0        LDA   0
7640:     24           CLC
7641:     101 1        ADC   1
7643:     133 1        STA   1
7645:     176 5        BCS   5 (= 7652)
7647:     160 0        LDY  # 0
7649:     76  252 28   JMP   7420
7652:     230 2        INC   2
7654:     208 247      BNE  -9 (= 7647)
7656:     234          NOP
7657:     165 0        LDA   0
7659:     24           CLC
7660:     101 1        ADC   1
7662:     133 1        STA   1
7664:     176 3        BCS   3 (= 7669)
7666:     76  205 28   JMP   7373
7669:     230 2        INC   2
7671:     76  205 28   JMP   7373
7674:     234          NOP
7675:     162 5        LDX  # 5
7677:     169 48       LDA  # 48
7679:     157 248 30   STA   7928,X
7682:     202          DEX
7683:     208 250      BNE  -6 (= 7679)
7685:     173 255 30   LDA   7935
7688:     56           SEC
7689:     253 244 30   SBC   7924,X
7692:     141 255 30   STA   7935
7695:     173 254 30   LDA   7934
7698:     253 239 30   SBC   7919,X
7701:     144 9        BCC   9 (= 7712)
7703:     141 254 30   STA   7934
7706:     254 249 30   INC   7929,X
7709:     76  5   30   JMP   7685
7712:     173 255 30   LDA   7935
7715:     125 244 30   ADC   7924,X
7718:     141 255 30   STA   7935
7721:     232          INX
7722:     224 5        CPX  # 5
7724:     208 215      BNE  -41 (= 7685)
7726:     162 0        LDX  # 0
7728:     169 48       LDA  # 48
7730:     221 249 30   CMP   7929,X
7733:     208 9        BNE   9 (= 7744)
7735:     169 32       LDA  # 32
7737:     157 249 30   STA   7929,X
7740:     232          INX
7741:     76  48  30   JMP   7728
7744:     96           RTS
7745:     234          NOP
7746:     234          NOP
7747:     14  255 30   ASL   7935
7750:     46  254 30   ROL   7934
7753:     170          TAX
7754:     173 255 30   LDA   7935
7757:     141 235 30   STA   7915
7760:     173 254 30   LDA   7934
7763:     141 234 30   STA   7914
7766:     14  235 30   ASL   7915
7769:     46  234 30   ROL   7914
7772:     14  235 30   ASL   7915
7775:     46  234 30   ROL   7914
7778:     173 235 30   LDA   7915
7781:     109 255 30   ADC   7935
7784:     141 255 30   STA   7935
7787:     173 234 30   LDA   7914
7790:     109 254 30   ADC   7934
7793:     141 254 30   STA   7934
7796:     138          TXA
7797:     109 255 30   ADC   7935
7800:     141 255 30   STA   7935
7803:     144 3        BCC   3 (= 7808)
7805:     238 254 30   INC   7934
7808:     96           RTS
7809:     234          NOP
7810:     162 0        LDX  # 0
7812:     189 249 30   LDA   7929,X
7815:     32  234 227  JSR   58346
7818:     232          INX
7819:     224 5        CPX  # 5
7821:     208 245      BNE  -11 (= 7812)
7823:     96           RTS
7824:     234          NOP
7825:     189 158 30   LDA   7838,X
7828:     208 1        BNE   1 (= 7831)
7830:     96           RTS
7831:     32  234 227  JSR   58346
7834:     232          INX
7835:     76  145 30   JMP   7825
7838:     32  76  73   JSR   18764
7841:     78  69  83   LSR   21317
7844:     32  67  79   JSR   20291
7847:     82           ?????
7848:     82           ?????
7849:     69  67       EOR   67
7851:     84           ?????
7852:     69  68       EOR   68
7854:     13  0   0    ORA   0
7857:     32  78  79   JSR   20302
7860:     84           ?????
7861:     32  70  79   JSR   20294
7864:     85  78       EOR   78,X
7866:     68           ?????
7867:     32  73  78   JSR   20041
7870:     32  84  65   JSR   16724
7873:     66           ?????
7874:     76  69  13   JMP   3397
7877:     0            BRK
7878:     32  76  79   JSR   20300
7881:     78  71  69   LSR   17735
7884:     82           ?????
7885:     32  84  72   JSR   18516
7888:     65  78       EOR  ( 78,X)
7890:     32  0   132  JSR   33792
7893:     0            BRK
7894:     169 0        LDA  # 0
7896:     205 255 30   CMP   7935
7899:     208 8        BNE  8 (= 7909)
7901:     205 254 30   CMP   7934
7904:     208 3        BNE   3 (= 7909)
7906:     76  233 29   JMP   7657
7909:     76  26  29   JMP   7450
7912:     0            BRK
7913:     0            BRK
7914:     0            BRK
7915:     72           PHA
7916:     12           ?????
7917:     50           ?????
7918:     0            BRK
7919:     39           ?????
7920:     3            ?????
7921:     0            BRK
7922:     0            BRK
7923:     0            BRK
7924:     16  232      BPL  -24 (= 7902)
7926:     100          ?????
7927:     10           ASL   A
7928:     1   36       ORA  ( 36,X)
7930:     36  36       BIT   36
7932:     36  36       BIT   36
7934:     36  36       BIT   36
```

Pseudo File Processing in BASIC

BY BRUCE SHOWALTER

Business computers, large or small, *must* be able to perform file processing. This is due to the nature of data. Also, field processing permits batching and mass off-line storage.

Personal-computer owners, with operating systems capable of file processing, know of its advantages, especially if the data is text or word oriented, rather than mathematical. However, personal computers in the lower price brackets usually run in BASIC, if they use any high-level language at all, and BASIC was not intended for file processing.

BASIC is primarily an interactive language; that is, the computer user is on-line while the program is running. File processing, by contrast, excludes the user from the execution phase of the program. While it is difficult to go on-line in a file processing environment, users can operate a make-believe or pseudo file process in an on-line medium, such as a personal computer with BASIC.

First, let's look at the fundamentals of file processing. Input data is recorded in a specific format, then collected and stored in a location accessible to the computer. As the data is processed, the generated output is likewise formatted and stored in a collection. Each unit of formatted data is called a record, and a collection of records is called a file. Individual data within a record are called items.

Now let's study an example of file processing. Suppose we have a clothing-store advertising department, and we want to maintain a list of customers so that we can mail out sales brochures from time to time. Our file will then be a list of names and addresses. Each customer will have one record in the file, and each record will contain four items: name; address 1; address 2; and address 3. If only two address lines are needed, the fourth item – address 3 – will be blank. When ready to send out our brochures, we program the computer to access the file and print the items in each record on a mailing label. So, the output file will be a batch of mailing labels, each being one record. The name will be on line one; the address on lines two, three and four.

At first, this might seem impossible in BASIC, since there are no file commands. Moreover, a fundamental system will probably not have any on-line storage. Data not coming from the keyboard will have to be in main memory. Here's where the pretending comes in.

A file of input records are stored as part of a program, using the DATA statement. The file might even be a user-defined subroutine callable by the main program, if the computer has that capability. Name and address records would simply be arrays of character strings. Each record would be thought of as a variable, and each item would be part of a subset of that variable.

In our example, we would have N$(4), where N$ is a name and address record, and (4) is the number of items in the record. Here's how two typical DATA statements might look:

```
200 DATA "JUDY BROWN", "829 TURNER ST.",
        "MILWAUKEE, WIS. 53202' , " "
210 DATA "JERRY CARPENTER", "424 RIVER-
        SIDE DR.", "APT. 22", "MILWAUKEE
        WIS. 53207"
```

This is a simple program to print a name and address list:

```
0010 REM PROGRAM TO PRINT NAME/ADDRESS
        LIST
0020 PRINT "HOW MANY NAMES",
0030 INPUT C
0040 PRINT
0050 FOR J=1 TO C
0060 FOR K=1 TO 4
0070 READ N$(K)
0080 PRINT N$(K)
0090 NEXT K
0100 PRINT
0110 NEXT J
0120 PRINT "END OF LIST"
0130 DATA . .
  *     "
  *     "
  *     "
  *  END
```

In this program, C is the quantity of DATA statements. When this amount of records has been processed, the computer will print END OF LIST and stop. As each record is processed, the four items are read and printed in succession. A blank line is printed between records.

Apparently, sequential processing is the only method available in this situation. There appears to be no means of printing one specific record without printing the whole list. However, by adding one more item to each record, we can accomplish this. The first item in each record will be a number, serving as a record identifier. We'll call this item R. Here is an example of how this identifier would be used:

```
0010 REM PROGRAM TO PRINT
  SELECTED RECORDS
0020 PRINT "WHICH RECORD
  DO YOU WANT",
0030 INPUT C
0040 IF C=0 THEN 190
0050 PRINT
0060 FOR J=1 TO 500
0070 READ R
0080 IF R=C THEN 120
0090 NEXT J
0100 PRINT "RECORD NOT
  FOUND"
0110 GOTO 20
0120 PRINT R
0130 FOR K=1 TO 4
0140 READ N$(K)
0150 PRINT N$(K)
0160 NEXT K
0170 PRINT
0180 GOTO 20
0190 PRINT "END OF JOB"
0200 DATA 001, "JUDY
  BROWN", etc.
```

C is the number of the particular record we want. When we are through, we enter 0, the computer prints END OF JOB and stops. In statement 60, 500 is the number of the last record in the file. This number must be accurate.

With each record having its own identifier, complete flexibility is obtained. This number can be used in a variety of ways to access records individually or in groups. Let's not forget that the INPUT statement and the keyboard are still available to the user. This conceivably would offer the user two input files; one from memory, the other from the keyboard. If MATrix operation is available, it would expedite the keyboard file concept.

So, if the advantages of file processing would facilitate your computing, but you don't have any real file processing commands, pseudo file processing may be your answer. □

Two Handy Programs in North Star BASIC

Here are two handy programs for North Star BASIC users. The first program, ADDSUB, enables you to combine two programs into one. The second, DUMPFILE, is useful for debugging complex programs dealing with data files, especially those using random access.

BY ILONA GROCHALSKA

Combining Two Programs

ADDSUB allows you to combine a subroutine with a main program in the memory. Let's refer to these programs as MAIN and SUB.

ADDSUB can be used with the original version of North Star BASIC. If you've modified your BASIC by changing the value stored at 2AOA to your top of memory, the ADDSUB can also be used. In these cases lines 30 thru 140 are not necessary. If in your BASIC you have replaced top of memory address by the call to the subroutine which searches for the highest address of continuous memory, ADDSUB will use five bytes of memory at location 0 to 4.

Refer to ADDSUB run while following this description of usage.

1. Make sure that the highest statement number in MAIN is lower then the lowest statement number in SUB. Since it is necessary to have sequential statement numbers for a program to run properly, a provision must be made so that the number sequence of the part to be added is consistent with the MAIN (original program). It is not done automatically. By using this method we bypass usual input checking routines of BASIC.

2. Load the MAIN program and find the amount of free space left by typing PRINT FREE(O) or !FREE(O). Type these commands immediately after loading to avoid creating variables and I/O buffers, thus overestimating the size of MAIN program.

3. Load ADDSUB and run it. The program will print out the top of memory available to BASIC in hex and decimal for your convenience. This allows you to compare it with an actual top of memory. When the program asks you for free space, type in the amount from step 2. The program will print out the address at which you should load the subroutine.

4. Load MAIN and go to DOS by typing BYE. The Disk Operating System will prompt you with an asterisk.

5. Load SUB at the address from step 3, using command LF.

6. Jump to 2AO4. List the program to make sure no error occured. It's possible that the combined size of MAIN and SUB is too large for the memory available. A typing error could also occur. If the program looks right, save it.

ADDSUB Run (user's input underlined)

```
LOAD MAIN
READY
PRINT FREE(O)
7143
READY
LOAD ADDSUB
READY
RUN
*** TOP OF MEMORY FOR BASIC IS - 32767 ***
HEX 7FFF
FREE SPACE IS ?7143
******* LOAD SUBROUTINE AT LOC 644E *******
READY
LOAD MAIN
READY
BYE
*LF SUB 644E
*JP 2A04
READY
LIST
• • •
SAVE MAIN
```

ADDSUB Program Listing

```
10 DIM H$(20)
20 !"*** TOP OF MEMORY FOR BASIC IS -",
30 REM ***** IF LOCATION 10760 CONTAINS A CALL ****
40 REM ***** TO SUBROUTINE  - DECIMAL 205 *****
50  REM     FILL BYTES 0 - 4 WITH FOLLOWING:
60 REM          CALL 558C
70 REM          XCHG
80 REM          RET
90 REM ***** TO MOVE A VALUE FROM HL TO DE *****
100 A=EXAM(10760)
110 IF A  205 THEN160
115 FILL0,205
120 FILL1,140/FILL2,85
125 FILL3,235
128 FILL4,201
130 D=CALL(0)
135 !D,"***"
140 GOTO400
160 D=EXAM(10761)
170 REM ***** GET ADDRESS STORED AT
    2A0A - 10761 DEC ****
180 GOSUB2000
185 REM ***** CONVERT IT TO HEX *****
190 Y$=H$
195 REM ***** COMBINE IT WITH
    SECOND BYTE OF ADDRESS ****
200D=EXAM(10762)
220GOSUB2000
230H$=H$+Y$
250GOSUB1160
300!D," ***"
400A=D
420GOSUB2000
440!" HEX ",H$
460INPUT"FREE SPACE IS ?",P
480A=A-54
460D=A-P
500GOSUB2000
520!"******* LOAD SUBR AT LOC ",H$,"*******"
540END
1000REM *** CONVERT HEX TO DECIMAL ***
1100REM *** INPUT H$  OUTPUT D ***
1120REM *** ASC("A")=65,ASC("F")=70 ***
1140REM *** ASC("0")=48,ASC("9")=57 ***
1160D=0
1200FORI=1TOLEN(H$)
1230A=ASC(H$(I,I))
1240IFA<48THEN1500
1260IFA>70THEN1500
1280IFA>57ANDA<65THEN1500
1300IFA<60THEN1400
1320D1=A-55
1340GOTO1460
1400D1=A-48
1460D=D*16+D1
1480NEXT I
1490RETURN
1500REM *** ERROR ROUTINE ***
1520!"ERROR ON INPUT - RETYPE"
1540INPUT"HEX ?",H$
1560GOTO1160
2000REM *** CONVERT DECIMAL TO HEX ****
2100REM **** INPUT D - OUTPUT H$ ****
2200D1=16
2220H$=""
2240D2=INT(D/D1)
2260IFD2<16THEN2320
2280D1=D1*16
2300GOTO2240
2320D=D-D2*D1
2340IFD2>9THEND2=D2+55ELSED2=D2+48
2360H$=H$+CHR$(D2)
2380IFD1=1THENRETURN
2400D1=D1/16
2420D2=INT(D/D1)
2440IFD2>15THEND2=0
2460GOTO2320
```

Displaying Contents of Data Files

Often you can't tell if data has been written incorrectly into the file or if an error occured during data access. With this DUMPFILE you can see what is actually in the file.

If you use a screen to display output, setting the speed to a large integer will allow you to read the contents of the file as they are printed.

The number on the right side are byte addresses of the data in the file.

DUMPFILE Run

(user's input underlined)

```
LOAD DUMPFILE
READY
RUN
SPEED (0 - SLOWEST)?100
FILENAME ?TESTFILE
0                                   5
445.87                              10
ABCDEFG                             19
48                                  24
READY
```

DUMPFILE Listing

```
100 INPUT"SPEED (0 - SLOWEST)?",R
120 DIMA$(10),B$(3000)
140 INPUT"FILENAME ?",A$
160 OPEN#1,A$
180 C=TYP(1)
200 FOR I=1TOR
220 NEXTI
240 !TAB(50),N
260 IFC=2THEN440
280 IFC=1THEN340
300 CLOSE#1
320 END
340 READ#1,B$
360 N=N+LEN(B$)+2
380 N=N+INT(LEN(B$)/256)
400 !B$,
420 GOTO180
440 READ#1,B
460 N=N+5
480 !B,
500 GOTO180
```

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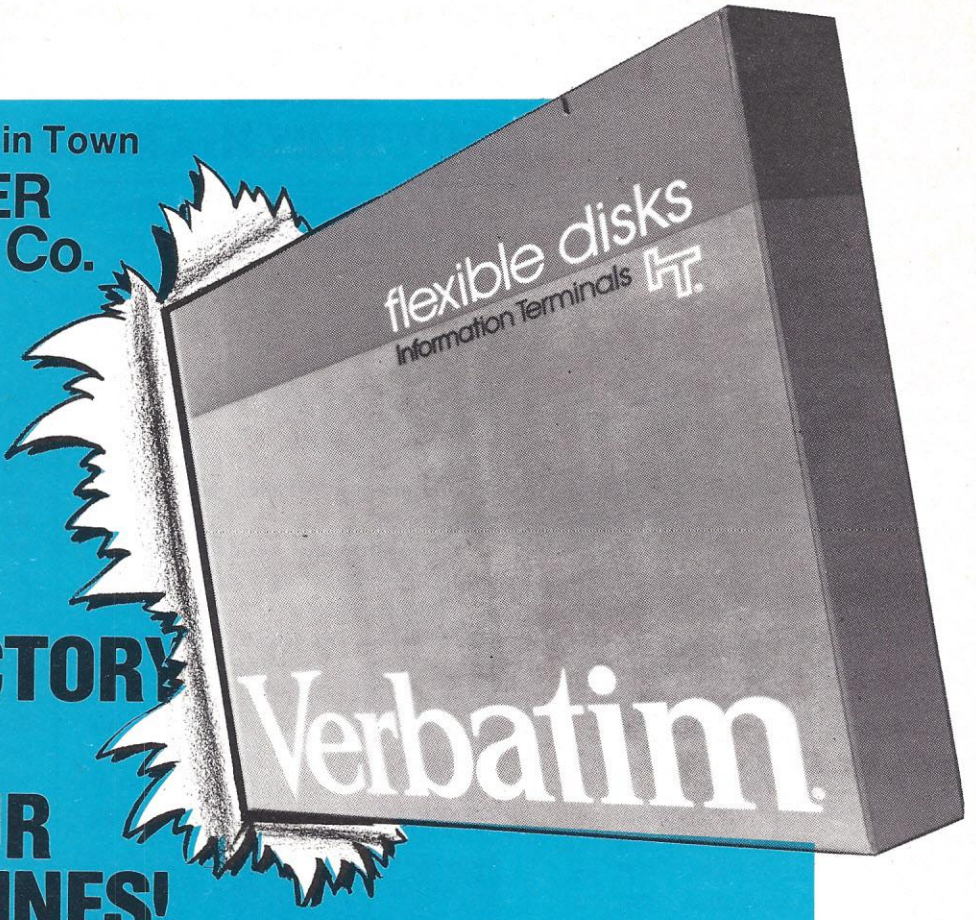

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CIRCLE 9

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HARRY SHERSHOW – Dept. Editor
MORRIS MILLER – Chess Annotater

During the December 9th ACM Computer-Chess Tournament in Washington, Ben Mittman, Northwestern University, led an open discussion among chess participants and the audience on the future of computing chess. "Microcomputer chess activity has grown immensely," he said in his introduction. "Many activities that one sees now – a lot of publications that one reads – concern the programming of chess on small machines. So, where are we headed – in both the big computers and the chess-playing cigar boxes – as some people like to call them?"

Kathe Spracklen, co-author with her husband Dan of SARGON II, one of the two microcomputer chess programs entered in this 3-day tournament, was the first to respond. "With small computers available now in virtually everybody's price range, I think that a real contribution from the micro programmers is just around the corner. Someone asked me, 'Will microcomputers ever challenge giant machines for the world championship?' My reply is that I don't think we'll ever have an advantage in computing power that could give us a first place position. But I think that it is quite possible that from the world of microcomputers will come improvements and algorithms that the larger programs will be scrambling like mad to copy. Another thing we've done that the big programs haven't – we've published *everything* that we've produced. We've done documented listings and explanatory articles right down to the instruction levels that say 'Here's how you do it.' And we think it's about time that someone who wants to write a new program doesn't have to re-invent the wheel. So you can start with move-generation logic that's already written, and alpha-beta pruning, which is already programmed. Then you can go right into the fun part which is the evaluation segment. I think that with such documentation – that we, together with what many others are doing – and with the explosion in microcomputers on the world market – we're really going to see some major remarkable progress in computer chess coming out of the small machine."

Monty Newborn, of McGill University, is optimistic about the future of computer chess. "The field is moving faster than we realize," he declared. "Right now we have four or five programs playing close to 2000 USCF rating. Two years ago we didn't have any programs at all playing 1800 level chess. So you see that the field is moving faster than we imagine. In another two years, I think that in order to qualify for entry into this tournament you'll have to have at least a rating around 1800. The level of play has become very, very exciting. Chess programs are spreading into the houses of hundreds of thousands of Americans. The average person who can't find a chess opponent to play a game at midnight, now has someone to play any time he chooses. I don't think that the average person is as good a chess player as the machines coming onto the market. These little dedicated computers are available now for $200 or $300 and are playing chess at a 1300 to 1500 level. They are improved and upgraded every year. In two or three years, they'll be playing 1700 to 1900 chess. In five to ten years there'll be units the size of cigar boxes – as Ben Mittman suggested – that will be playing chess at the master level. It is my guess that within the next ten years we'll have a program that will be as good as any human.

"As these things are developing the human chess players will be watching nervously. It will be interesting to see how they will respond as programs get better and better. The question arises: will the human chess player accept all this as a friendly development within the concept of human progress and intellectual advancement? Or will hostility break out between man and machine?

"It is going to be interesting, also, to see what happens when the computer gets to be as strong as Bobby Fischer. Would Bobby, then, be willing to sit down and have a go at this machine that will be rated at his own level? I think that will happen in about five or ten years, and it will be an interesting event if it takes place."

Tom Truscott, of Duke University, had a longer-range prediction. "I think that in 30 years, the programs will be so strong that the commentators at the tournament will them-

During the panel discussion, David Levy read birthday greetings to honored guest Dr. Edward Lasker. Other members of panel were (l. to r.) Ben Mittman (moderator), Monty Newborn, Tom Truscott, David Slate, Kathe Spracklen, and Mike Johnson.

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CIRCLE 10

selves be computers, he said. "Humans will not understand what is going on in the game. It will be several levels beyond what we can understand. But we're not there now. In the next few years I believe there's going to be a rapid improvement in hardware. Right now, the programs are relatively stupid in their searching procedures. Many are doing full-width searches and it seems to me that there is a tremendous waste of information. Our own program, DUCHESS, is going to go back to selective searching in the near future. But not with the relatively arbitrary decicions that have been made in the past; such as, look at exactly five moves from each position. A more mathematical approach should be taken which uses searching to reduce the uncertainty due to inexact evaluation functions. The idea of the tree would be to produce a small variance, and not to produce the value itself or even to produce a move."

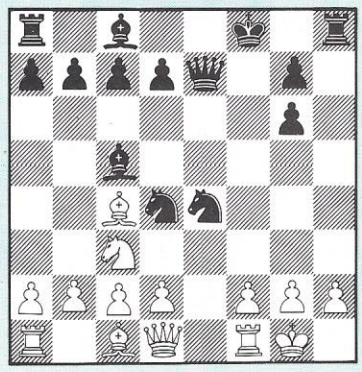
"I'm fairly optimistic about the future," said David Slate of CHESS 4.7 and Northwestern University. "However, I wouldn't want to be pinned down and predict when the machines will be able to beat grandmasters. But I think we'll be seeing progress on the machines on two fronts. A few years ago it was thought that brute force full-width search techniques wouldn't go anywhere because each additional ply of search required a factor like 6 to 1. And even increasing the speed of the machine on the order of 1000 to 1 didn't buy that much additional ply. Improvements had to come in the greater sophistication of algorithms, position evaluation and more selective tree searching. Full-width approach has proven somewhat stronger than was originally anticipated. That accounts for the success with programs like ours. In the long run, progress in programs will be a combination of both an increase in speed of hardware and an improvement of evaluation function and selective tree searching. The reason we haven't seen rapid improvement in these fields is that they're more difficult than doing brute force full-width evaluation – the way we're doing it now. Anybody who's done any computer programming at all knows that it takes a long time to implement a relatively simple idea. Even ideas that seem quite simple on the surface may take ten or 20 years to implement. In fact, what's happened in the past is that sometimes several years go by and not too much progress seems to have been made in computer chess. Then, some observers in the field say that, since we don't seem to be getting anywhere in improving the sophistication of the program, therefore the future looks bleak. But, I think you really have to look over a very long time range. Getting a simple idea to improve a chess program may take years to implement – years of work. As a matter of fact, right now I'm working on a new CHESS 5 version of our program which is going to be a complete rewrite of the CHESS 4 version. It's perhaps 60% completed, at the moment, and we hope to complete it sometime next year for the 10th ACM tournament. Our next program is basically not much different from CHESS version 4 in the way it goes about selecting a move. Beyond that, the new program will be more modular, a little more general, a little more elegant, a little more transportable and nearly as efficient as CHESS version 4. It will be constructed to allow introduction of more sophisticated evaluation and more sophisticated tree searching. When finished, the program will increase our strength rating by perhaps 200 points over what we have now.

"This is just the first step in a process that will last several years. Then

The ACM '78 Title-Match Game

White- *BLITZ*	Black- *BELLE*
1. e4	e5
2. Nf3	Nc6
3. Nc3	Nf6
4. Bb5	Nd4! (a)
5. Bc4	Bc5
6. Nxe5?	Qe7
7. Bxf7ch (b)	Kf8
8. Ng6ch	PxN
9. Bc4	Nxe4
10. 0-0	RxP! (c)
11. KxR	Qh4ch
12. Kg1	Ng3
13. Qh5	PxQ
14. PxN dis ch	Nf3 double check & mate

Position after White's 10th move, 0-0



(a) The Rubinstein Variation of the Four Knights. BELLE has an excellent opening. Best for White is 5-NxN, PxN; 6-e4-e5! If Black tries to win a Pawn at the expense of development, White comes out on top: 7-PxN, PxN; 8-PxPch, BxP; 9-QxP, 0-0 followed by Bc3.

(b) Best is 7-Nf3, Nxe4; 8-0-0. If 7-Pf4, Pd6. If 7-Nxf7, Pd5! etc.

(c) A really charming combination but it took White's cooperation in opening the rook file. (See diagram).

This game, pretty though it undoubtedly is, belongs in the era of 19th century Romantic chess. No master, or even first rate player, plays today as White did. Tactical programming is shown at its best. – M.M.

there'll be additional steps in attempting more interesting and more complicated programs. I think that one of the keys in improving programs from the software viewpoint is that one has to design it so that it's structured in such a way that one can express valid chess concepts to the program. The goal of a chess programmer is to be able to give his program ideas simply, easily and quickly without worrying so much about details of computer programming.

"To sum it all up, I think of our new CHESS 5 program as a version that everyone thought was written ten years ago."

The tournament came to a conclusion on the third day's final round, when Bob Hyatt's BLITZ confronted Ken Thompson's BELLE in a game that was to decide the winner of the tourney. A win for BLITZ would have given it the title and would have put BELLE into a tie for 2nd place with CHESS 4.7. The subsequent loss for BLITZ, however, dropped that program into a three-way tie for third place. This focal game turned out to be the shortest one of the tournament, (14 moves) to the amazement of both Bob Hyatt and the audience.

The Roycroft Challenge

During Edinburgh University's computer-chess conference, held in April of 1978, Prof. Donald Michie invited John Roycroft, among others, to try to solve the end game of King-and-Rook versus King-and-Knight. Roycroft was challenged to play the Rook side for a win against the computer under tournament constraints. The computer had Ken Thompson's (of Bell Labs) database containing some three million different positions, with the Knight's side best defensive moves entered. Roycroft failed to solve the selected-position problem during the regular conference play but returned the next day with the correct solution. In the following story (reprinted with permission from the author and from Computer Weekly, Dorset House, Stamford Street, London SE1 9LU) John Roycroft discusses that incident.

"Edinburgh End Games"

- by John Roycroft

The task was simply this: I was presented with three positions known to be won for the side with the Rook in a battle against a lone Knight and I was to win them. The diagrams No. 1, No. 2 and No. 3 show the position and following is how the play went.

(In this "dialogue", John Roycroft acts as his own interviewer.)

Q. Was this a straight contest between chess player and computer?

A. No. True. I did play with a clock (at the rate of 16 moves per hour, the equivalent of tournament chess and its 2½ hours for 40 moves) and I did not have any moves back. On the other hand, I had over a week's notice of the positions and naturally I prepared for the contest. In chess terms it was like having an adjourned game.

Q. How did you prepare?

A. I was already familiar, without being move perfect, with what the books give on this ending. Then, I had learned a lot from playing against the same database at the April two-day conference in Edinburgh. Thirdly, I asked for and was given, in advance, four positions (and the single line optimal play) with the same solution length as the contest positions, so that I could have some training that was relevant.

Q. I notice that the solutions are all 24 moves long. Why is this?

A. Professor Michie had them chosen at random from the 178 such positions with the idea that the near maximum length (no position has an optimal solution exceeding 27 moves) and the number of such positions would provide the toughest and fairest contest conditions.

Q. You played with a chess clock to measure your thinking time. How much time did you take?

A. In fact, about five minutes for each position.

Q. That's very fast, isn't it?

A. Yes. Or rather, it seems so. In fact, my preparation was pretty good and most of the difficult moves I had already written down.

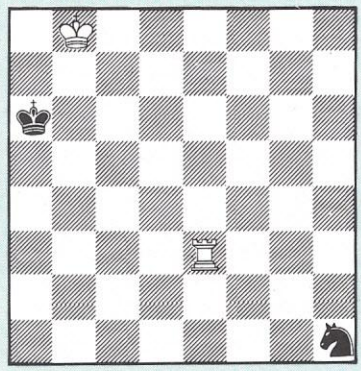
Q. You mean you had notes? That's not like tournament chess, is it?

A. Quite right. Not only did I have notes, but an auxiliary board on which I moved the pieces around when I wanted to before choosing the move to be played on the primary board. This was all agreed in advance. But I used the auxiliary board seriously only twice. The contest was between a chess analyst and a database, not between an over-the-board master and a database, so the conditions were deliberately made to ensure that the analyst, myself, could not complain.

Q. Coming to the play, is not the solution to Position 3 very similar to that to Position 1?

A. Yes, it is. In fact, it's a mirror image, or almost, from move 5 onwards. We were all surprised at the lack of variety, certainly the apparent lack of variety, in the core of the solutions. Even Position 2 was like one of the positions given to me in advance and the 1 and 3

Position No. 1



Game No. 1

1.	Rb3	Ka4
2.	Kc7	Sf2
3.	Kc6	Ka4
4.	Rf3	Sd1
5.	Kc5	Sb2
6.	Rh3	Sd1
7.	Kc4	Sb2+
8.	Kc3	Ka3
9.	Rg3	Sa4+
10.	Kc4+	Ka2
11.	Rg5	Sb2+
12.	Kc3	Sd1+
13.	Kc2	Se3+
14.	Kd2	Sc4+
15.	Kc3	Se3
16.	Re5	Sg4
17.	Re6	Kb1
18.	Kd2	Sf2
19.	Rb6+	Ka2
20.	Rb4	Sh1
21.	Rg4	Ka3
22.	Ke3	Kb3
23.	Rg1	"Resigns"

lines were not new to me. But 1 and 2 are quite distinct from each other.

Q. So you were not just reading from your paper database while the computer was reading from the magnetic one?

A. Almost. Of course, I had to be sure and had to be able to recognize a similar position in any of its eight possible orientations, due to rotation and reflection. This was a mental, not a paper, process. And the program might have diverged, by selecting an alternative, equal depth move at many possible branching points, though it did not. But certainly most of the work was in the preparation and a great deal of the play was accidentally (not deliberately, anyway) to be found in the practice positions.

Q. Which of the three positions would you call the "best?"

A. Position 2 is quite beautiful. And it won't be found in textbooks. Take the position after Black's third move. The Black Knight and Black King are striving to meet, to set up a standard drawing condition with both men next to each other on the edge. White has to play very precisely to prevent this. In fact, I find the next ten moves a sheer delight.

Q. Can you be more specific?

A. Consider the position after 8. Rh7+. Where can Black now play his King? If he goes to e8 or f8, the Knight is immediately lost to a Rook check on h8. If he goes to g8, however, the Rook plays to c7 winning the Knight by domination, because it has no safe squares. The same applies to the move of Black's King to g6. So, in spite of the apparantly wide choice, Black really has only e6 and f6 to choose from. But even e6 falls to Rh6+ and the variety of ways in which the Knight is now caught in just a few more moves is quite delightful. So, really, only f6 will do for Black. The effect in the mind of comprehending each of these variations individually, and all of the variations as a group is strongly aesthetic.

Q. Was that the end of it?

A. Not quite. After Positions 1, 2 and 3 had been disposed of, I asked for three more positions to be given me without preparation. Here, I would try to play fast but with up to three moves back. A kind of compromise between over-the-board competitive play and how the analyst works.

Q. And what happened?

A. Exactly the same result. I made no mistakes (to everyone's surprise including my own) and it was remarkably easy.

Q. How do you mean?

A. I assumed that the positions would transpose into solutions that I already knew – indeed into the essentially different Positons 1 and 2 lines or into one of the Edinburgh lines. And they did.

Q. What about an example?

A. Certainly. Take position No. 4. It was not too difficult to find 1. Ke7 Kh6; 2. Kf6 Se3; 3. Rg3 Sd5+ 4. Ke6 Sc7; 5. 5. Kf5 Se8 6. Rg6+ Kh5 7. Rc6 and we're back in game No. 1 with little difference.

Q. How many moves back did you have in these three "unseen" positions?

A. None. It turned out, so Michael Clarke told me, that all the moves I made were optimal. That is, no moves I made prolonged the solution unnecessarily.

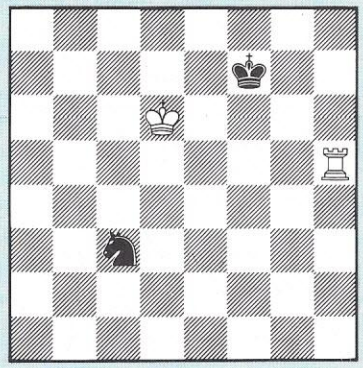
Q. What now?

A. Donald Michie thinks that it might be possible to construct an "expert system" that will play the ending in a non-look-up manner. He was interested in how I tackled the contest.

Q. And how did you?

A. By looking for patterns. For instance the play in all these long-solution positions seems to fall naturally into three phases. In the first phase the chessmen are relatively dispersed, but Black must get his King and Knight

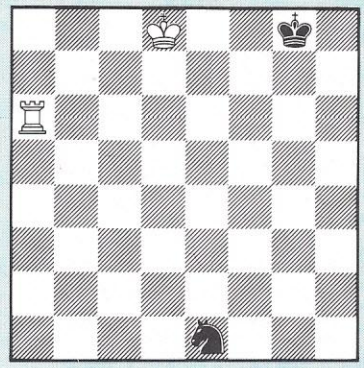
Position No. 2



Game No. 2

1.	Ke5	Sa4
2.	Rh7+	Ke8
3.	Kd6	Sb6
4.	Rh8+	Kf7
5.	Rh4	Sc8+
6.	Kd7	Sb6+
7.	Kc6	Sc8
8.	Rh7+	Kf6
9.	Rh6+	Kg7
10.	Re6	Sa7+
11.	Kd6	Kf8
12.	Kd7	Sb5
13.	Re3	Sd4
14.	Re4	Sb3
15.	Kd6	Kg7
16.	Kd5	Sd2
17.	Rf4	Sb1
18.	Rf3	Kg6
19.	Rd3	Kf5
20.	Kc5	Ke4
21.	Kc4	Ke5
22.	Kb4	Ke6
23.	Rd1	"Resigns"

Position No. 3



Game No. 3

1.	Ke7	Kg7
2.	Ra3	Kg6
3.	Ke6	Sc2
4.	Rg3+	Kh5
5.	Kf5	Kh4
6.	Rc3	Se1
7.	Kf4	Sg2+
8.	Kf3	Kh3
9.	Ra3	Sh4+
10.	Kf4+	Kh2
11.	Ra5	Sg2+
12.	Kf3	Se1+
13.	Kf2	Sd3+
14.	Ke2	Sf4+
15.	Kf3	Sd3
16.	Rd5	Sb4
17.	Rd6	Kg1
18.	Ke2	Sc2
19.	Rg6+	Kh2
20.	Rg4	Sa1
21.	Rb4	Kh3
22.	Kd3	Kh2
23.	Rb1	"Resigns"

In all cases White captures the black knight on his 24th move.

together, or perpetually threaten to. At the end of this we enter a second phase, the kernel of the struggle where a sequence of a dozen or so moves decides it, because eventually the Knight is forced away from its King. Phase three mops up the Knight. Of course, mate threats operate in any phase of the struggle, even in all phases.

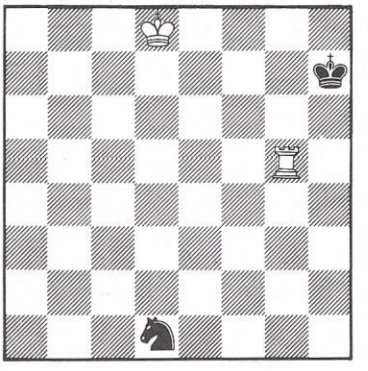
Q. This phase two is the most interesting?

A. I certainly think so. There should be a closer look at the database to verify our conjencture about the limited number (three) of distinct "second phase" move sequences. It will be very curious, but it seems a definite possibility, if the patterns of play are different with different solution lengths. To be sure of this will require a great deal of work.

Q. Why aren't all positions at the "maximum length" of solution?

A. What is most relevant is having a position with no antecedents nor ancestors. The way the database was constructed, backwards, from all terminal positions, ensures that the White moves are the best (win fastest) and the Black moves are also the best (delay the win longest or seize a draw.) This process pursued for all possible positions (over 3,000,000) allows a table to be constructed showing how many positions

Position No. 4



exist for each possible length of solution. Consider Diagram 1. It's White to play, so Black moved last. But aside from the possibility of capturing some fifth man, there is no previous move available that is a best move – that is, all possible previous moves (moves leading to the diagram) are bad, in the sense that alternative moves are available that will draw. Therefore the backing-up procedure, by which the program has generated the database, is at an end for this particular sequence – it's the end for the program but the beginning for the player. Naturally, these "no ancestors" positions arise at all move depths.

(John Roycroft, editor of EG, acronym for "EndGame" is author of 'Test Tube Chess," an analytical book on EndGame solution with 470 diagrams.)

(In the preceding algebraic documentation, the author prefers to use the symbol "S" for Knight, rather than "N". "Why 'S' for Knight?" asks John. "Because 'Kt', when used to avoid confusion with 'K', is clumsy. And 'N' is shared with no other country. 'S' is for Springer, the German name for the chess piece and is much more widely known and used than 'N'.")

Chess Chatter

... Computer Game Programs announces that OSTRICH 79, one of the world's strongest chess-playing programs is now available for purchase. Earlier versions of the program finished as high as second in one of the annual North American Computer Chess Championships sponsored by the ACM. In 1974, the program just missed defeating the Soviet program, KAISSA, in the World Championship at Stockholm, won by the latter program. OSTRICH 79 is clearly stronger than earlier versions.

OSTRICH 79 executes on all Data General Nova, Micronova, Supernova and Eclipse series computers. A player can set the program to make moves at any desired speed from seconds to hours. Strength increases as greater move time is allowed. Any desired position can be entered. OSTRICH 79 selects moves randomly to some degree and consequently an infinite variety of games is possible.

Two different versions of the program are available. The Experimental Model (OSTRICH 79E) allows the user to obtain data and statistics on what the computer is thinking when selecting a move. The system configuration is at least 32K memory, a real time clock, and a teletype (Price: $160). The Standard Model (OSTRICH 79S) requires only 16K, a real time clock, and teletype (Price $100).

Each model is provided on diskette as a SAVE file. It can be loaded under DOS, RDOS or AOS from a Data General diskette drive (D.G. 6030) or equivalent. Operating instructions are provided.

For hours of fun, write Computer Game Programs, 1700 Ohio Savings Plaza, 1801 East Nineth Street, Cleveland, Ohio 44114.

... Prisoner's Dilemma is a "game" in the artificial intelligence concept and its "vocabulary" is similar to that of chess where the computer program is stepped forward to the point where it must make a decision based on the information it has acquired. In "Prisoner's Dilemma" two suspects are taken into custody and separated from each other. The District Attorney is certain that they are guilty of a specific crime, but he does not have adequate evidence to convict them at a trial. He, thereupon, suggests to each prisoner (separately) that there are two alternatives: to confess to the crime the police are sure they have done, or not to confess. If they both do not confess then the D.A. states he will book them on a trivial, trumped-up charge for which they will both receive minor punishment. If they both confess then they will be prosecuted, but he will recommend less than the most severe sentence. However, if one confesses, and the other does not, then the confessor will receive lenient treatment (for turning state's evidence) and the other guy will get "the book slapped at him." The problem for each prisoner is to decide whether to confess or not. Professor Robert Axelrod of the University of Michigan's Institute of Public Policy Studies, 1516 Rackham Building, Ann Arbor, MI 48109 invites participants to join the "hobbyists round" of a computer tournament. Everyone who enters will get a research report on the project and the winner will get an engraved trophy. There is no charge to enter. Professor

Axelrod says participants should have as much fun designing an entry as he does in analyzing the results. Deadline is the middle of March and anyone interested is advised to rush off a letter to the professor.

. . .Membership in the International Computer Chess Association (ICCA) is open to everyone and the first year's dues are $5.00. (Application for membership can be made by writing to ICCA, Vogelback Computing Center, Northwestern University, Evanston, IL 60201.) In the last ICCA newsletter, Don Beal of London's Queen Mary College, suggests a method for handicapping chess-playing computers based on speed. "If there are enough people interested in this project," he writes, "I will take it a step further and draw up a table of relative speeds for all computers used in a recent tournament." Comments, with an "agree" or "disagree" opinion, should be sent to the ICCA newsletter.

. . . . . Evan Katz, of 61 Tara Drive, Roslyn NY 11576, is the most enthusiastic computer-chess aficionado we have met to date. "Boy, am I glad that I found out about your magazine," he writes, his words bubbling over almost at feverish pitch. "My communication in this field in the past has been confined to personal correspondence with people like Slate, Levy, Atkins, Newborn and Frey. These people are really 'into' (the best word to use including feelings such as 'excited,' 'compulsive' and 'enthusiastic') computer chess. Most of the people active in this field are down in Silicon Valley or in the Chicago area and you should see my monthly phone bill and worn-down typewriter! I am a sophomore at Roslyn High School and have enjoyed both chess and computers for some time. I am about a Class A or B chess player and specialize in extended BASICs and I also have some knowledge of FORTRAN IV and COBOL. I own the CHESS CHALLENGER 10 and find that it gives me a good game at level nine – the six minute response. I have an order out for the new SARGON for the TRS-80. I hope this will pose a greater challenge than Peter Jennings's MICROCHESS 1.5 which I defeated 5-0 at level three in a simultaneous at a local Radio Shack store. I also had the pleasure of giving a 2½-hour lecture on CHESS CHALLENGER 10 and computer chess at the Personal Computer Fair in New York (while playing the Chess Challenger at level five) during the summer of 1978. Unfortunately, no matter how much knowledge I have been able to accumulate, I have not as yet had enough spare time to fulfill my ambition of creating my own chess program, employing my own thought heuristics. Some day! I certainly must be Larry Atkins', David Slate's and David Levy's biggest 'brain picker' as I try to fulfill my immense quest for knowledge."

. . . From our backlog of letters, appears this one from Tony Lovatt, of 586 Madras Street, Christchurch 1, New Zealand: "At the moment I do not have a working computer, but I do have some thoughts on computer chess. First, a decent language is necessary. At work I have the doubtful privilege of using an assembler for the 6800 all day. At home, I've decided that, at the very least, I'll have to use version three (with BEGIN . . . END blocks) of Jack Emmerich's Tiny Assembler, and preferably a high-level language. I'm against BASIC on general principles, but there are plenty of other high level languages around. Several of my friends here in New Zealand are writing compilers or interpreters for PL/6800, PASCAL, ALGOL subset and (believe it or not) Knuth's MIXAL. My favorite is FORTH, because this is stack oriented and desirable, I think, for a chess-playing program. My thoughts on a chess program begin with my current inclination towards the use of a tagged tree; that is, each node is optionally tagged with data indicating the (empirically determined) use, priority and characteristics of its subtree. This can allow very heavy tree pruning, with the tags giving guidelines as to whether it's worth regenerating a particular pruned subtree. All pruned subtrees can be dumped on to backup store for later perusal; it's my thought that the program would "think" about chess all the time, the same as a human player does. Note that an 'opening book' would be represented simply by tagging some of the lower nodes with 'high priority' flags. Any departure from the opening book could be coped with *no* change of strategy."

. . . . . Lee Robertson of PO Box 2154, Salt Lake City, UT 84110, writes about his experiences with the Knight's Tour program in BASIC. "About a year ago I tried to solve the problem using a program similar to Dan Clarke's program in the December PC issue. After two days the program had made 62 moves. I got fed up and turned it off. Several weeks ago I wrote an Assembly Language program and tried again. This time I was determined to get a solution. I let the program run for 4 days and it was nowhere near a solution. While it was running I made some calculations and decided that it was making over 5,000 moves a second. After four days it had made over one and a half billion moves!

"At this time I was quite disillusioned and turned it off. The next weekend I was looking at the results of the previous run and noticed a move it had by-passed earlier in the run. It was taking a long time working its way back down to pick it up. My next attempt included a means to stop the execution of the program and back it up when I could see it had made an error. Lo and behold! It came up with a solution. In one afternoon I was able to get eight different solutions. One solution is included here. To read it start at 1 and go to the next number.

SOLUTION TO THE KNIGHT'S TOUR:

1	56	45	50	41	58	61	64
44	51	2	57	62	35	40	59
55	46	53	42	49	60	63	34
52	43	48	3	32	25	36	39
47	54	31	24	17	38	33	26
20	23	12	29	4	7	16	37
11	30	21	18	9	14	27	6
22	19	10	13	28	5	8	15

Notations used in this computer-chess department are either Algebraic Notation or "American" Descriptive. For the enlightenment of readers in foreign countries, the chess symbols commonly used in "American" Descriptive notations are:

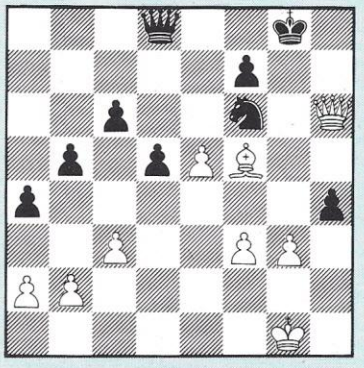
P	=	Pawn
R	=	Rook
N	=	Knight
B	=	Bishop
Q	=	Queen
K	=	King

Romanian computer loses to newspaper readers

The struggle taking place in Bucharest with readers of the Romanian newspaper Magazinul playing a public chess match against a computer has finally come to an end and the computer, known as Felix the Cat, can now go back to catching mice. Officially named Felix 256 the computer, running the program of ASTRO 64, was cornered by the collective move-decisions of the readers and with no escape routes in sight, it finally resigned gallantly – according to U. Valureanu, correspondent for the Bucharest newspaper, who has sent us a constant stream of of dispatches from the battlefield. Readers in foreign counries, noticing frequent comparison of the Romanian computer to a cat, may wonder at the significance. In explanation, Felix is the well-known name of a cartoon character that appeared in American comic strips years ago. It was also among the first animated characters to appear on the screens of film houses throughout the world. Felix the Cat was the predecessor and probably the inspiration, for Mickey Mouse, the famous Walt Disney creation that followed on the heels of Felix. So, whenever the name Felix appears, the immediate connotation that arises is the one relating it to the feline cartoon-character. Romanian readers who might be sensitive about the cat connotation, should know that Felix the Cat was as well loved by children of America as Santa Claus or Fairy Godmothers.

The entire game, with all preceeding moves and the final current moves is shown below.

Position after White's 28th move.



White - *BUCHAREST READERS*	Black - *ROMANIAN COMPUTER*
1. P-K4	P-K4
2. N-KB3	N-OB3
3. B-N5	P-QR3
4. B-R4	P-QN4
5. B-N3	N-B3
6. 0-0	NxP
7. R-K (a)	P-Q4
8. P-Q3	N-B3
9. NxP	NxN
10. RxNch	B-K3
11. B-N5	B-Q3
12. R-K	0-0
13. N-Q2	P-KR3
14. B-KR4	P-KN4 (b)
15. B-N3	BxB
16. BPxB (c)	B-N5
17. N-B3	Q-Q2
18. Q-Q2	BxN
19. PxB	KR-K (d)
20. P-Q4	RxRch
21. RxR	P-QR4? (e)
22. P-B3	P-R5
23. B-B2	R-K
24. R-K5! (f)	P-B3
25. B-B5	Q-Q1
26. P-R4 (g)	PxP
27. QxP	RxR
28. PxR (Diagram)	Q-N3ch (h)
29. K-N2	PxP
30. Q-N5ch	K-B
31. PxN	Q-B7ch
32. K-R3	Q-R7ch
33. K-N4	P-B4 (i)
34. Q-N7ch (One move before mate)	Resigns

(a) Best is 7-P-Q4! now or even next move.

(b) ASTRO is too prone to weaken its Pawn formation. A heuristic should be programmed to counter-balance its heuristic to break pins.

(c) With the idea of attacking against the weakened King side via the Bishop file.

(d) An even and drawish position has been reached.

(e) Weakening, but ASTRO tries to win the Bishop. Positionally White must play P-B3 and B-B2 anyway. ASTRO has nothing better than R-K and swapping down.

(f) Now the readers start to make something of their game. 24-. . .RxR; 25-PxR, N-R2; 26-Q-Q3, N-B; 27-P-B4 with distinct chances for White. Even 27-. . .PxP; 28-PxP, Q-N5ch; 29-Q-N3, QxQch; 30-PxQ does not blunt White's Pawn march.

(g) Now 26-. . .RxR; 27-PxR, N-R2 (or Kl); 28-P-K6, PxP; 29-BxPch and Q-Q4. Black cannot afford then to exchange Queens because of B-Q7.

(h) Desperation, because if the Knight moves, White mates by B-R7ch, B-N6 dis ch, Q-R7 ch and QxP mate

(i) Only 33-. . .Q-R1 stops mate but then 34-KxP, threatening B-N4 and Q-K5, so if Black swaps Queens by Q-N1, the White Bishop plays B-Q7.

A good game by ASTRO, but the Readers obviously are strong group. - Morris Miller

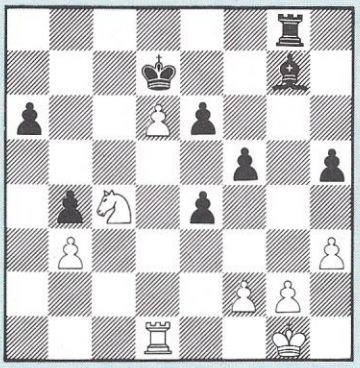
Stenberg's Loss to Chess 4.5 at Minnesota

. . . The Minnesota Open Chess Tournament which was held in February of last year found Chess 4.5 as one of the entrants against human players. The computer program was emerging into National prominence and had yet to be upgraded to Chess 4.6. During the Minnesota tournament, Chess 4.5's score (5 wins, one loss)

White: **Stenberg** Black: **Chess 4.5**

1. P-Q4	N-KB3
2. N-KB3	P-Q4
3. P-B4	P+P
4. N-B3	P-QR3 (a)
5. P-QR4	N-B3
6. B-N5	B-N5
7. P-K3	N-QR4
8. P-R3	B-K3 (b)
9. B+N	P/N+B
10. P-Q5	B-Q2
11. N-Q4	B-N2
12. Q-R5 (c)	K-B1 (d)
13. R-Q1 (e)	Q-K1
14. N-B5	P-N4 (f)
15. R-Q4	B+N
16. Q+B	P-N5
17. N-Q1	Q+P
18. B+P	N+B
19. R+N	R-Q1(g)
20. R+P/7	P-KR4
21. R-B8	K-K1
22. 0-0	Q-Q2
23. R+P ch	K+R
24. Q+Q ch (h)	K+Q
25. P-K4	R-QB1

White appears to be in good position here after completion of 30th move. He is mounting an attack on the King while pushing his Pawn to the 8th rank.



26. N-K3 (i)	P-B4 (j)
27. P-QN3	P+P
28. N-B4	R-KN1
29. R-Q1	P-B4
30. P-Q6	P-K3
31. N-N6 ch	K-B3
32. N-B4	R-Q1
33. N-R5 ch	K-Q2
34. N-B4	B-B6
35. K-B1	R-KN1
36. N-Q2 (k)	P-R5
37. N-B4	P-B5
38. N-Q2	B+N
39. R+B	P-B6
40. P+P	P+P (l)
41. R-Q3 (m)	R-KB1
42. K-K1	R-B5
43. K-Q2	R-B4
44. K-B2	R-B4 ch
45. K-N2	R-NK4
46. K-B2	R-KB4
47. R-Q4	R-B4 ch
48. K-N2	P-R4
49. R-Q3	R-K4
50. R+P	R-K7 ch
51. K-B1	K+P
52. K-Q1(n)	R-R7
53. R-Q3 ch	K-B4
MSG POSITION ADJOURNED	
54. K-K1	P-K4
55. P-B4	P+P
56. R-KB3	K-Q5
57. R+P ch	K-K6 White Resigns

(a) 4. . . . P-QR3. I also play this line. The main line I believe. White normally enters his N-B3 because he intends to play an energetic game, taking his opponent out of any of his known 66 accepted lines.

(b) 8. B-K3. Poor! Blocks the King's Pawn. Now, both 9 BxN and NPxB look strange. I prefer 9. P-K4 and after 9. BxN KP+B. Now Black's side is unnecessarily weakened.

(c) 12. Q-R5. There is no immediate threat from this, but the Queen puts pressure on Black if he castles on King's side. It does prevent P-K3 or K4.

(d) 12. . . . K-B1 What for? . . . P-QB3 or 4 would have been better. But still Black's position isn't that bad – he still has the two Bishops and, besides, White's KB is hemmed in.

(e) 13. R-Q1 looks good but Black's reply refutes the idea: 13. . . . Q-K1! This shows that the slower but surer 13. B-K2, 14 0-0, 15. N-B5 would have been better.

(f) 14. P-N4! Excellent! Instead of allowing White to trade off both of Black's Bishops just to win a RP. Black seizes the attack instead.

(g) Now White's 13. R-Q1 just looks like a clear cut error – the Rook should have stayed on QR1.
After 19. . . . R-Q1, we see that Chess 4.5 observes some tactics that class B players sometimes miss. For example, 20. RxBP P-K3 21. PxP QxN mate. But after 20. RxBP! anyway, we see a flaw in its tree search. It usually misses a non-capturing sacrifice by the opponent because if now . . . P-K3 then 21. Q-R5 forces the retreat 21 . . . Q-K1. Stenberg doesn't miss the opportunity.

(h) 24. QxQ Check. A bad decision and as Chess 4.5 the wrong one. Q-Q3 or even 29. P-K4 OxQ 25. Proves PxQ would be better as the Black Bishop must struggle to free itself. For example 25. PxQ B-R3 26. P-KB4. This unusual position on Black's bishop offers the opportunity of an unsual pawn position. Black's two pawn majority on the Queen side must now be reckoned with

(i) 26. N-K3? The logical move and also the losing move. 26. P-KB4 R-B7 is still bad but puts up more resistance.

(j) 26. . . . P-B4! Now Black has a winning end game.

(k) 36. N-Q2. There is nothing for White to do, now, but wait.

(l) By move 41 Black has dissipated part of his edge. White can now hope for a draw. Best is simply 41. R-Q4 winning a pawn, or at least trading his worthless QP for a better Black pawn.

(m) 41. R-Q3 combined with 42. K-K1?? seals White's doom. Even after 43. . . . R-B4 44. R-Q4 R-Q4 leads to a losing King and Pawn end-game.

(n) The remainder of the game (moves 53 to 57) are White's last gasp. He could have lasted till move 65 or so with 52. K-N1 and if 52. . . . R-R6 53. R-K3 to prevent . . . P-QR5.

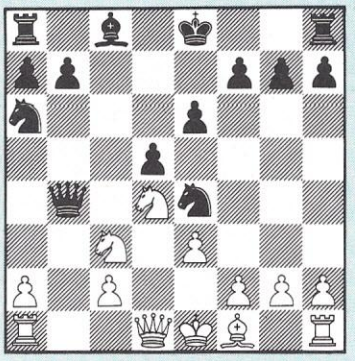
– Gary Boos

enabled it to enter a round robin for the state championship. It did poorly, there, scoring 1½-3½ and beating only one player who had become extremely careless in the latter moves of the game. In the regular tournament itself, whose results and annotations and comments have been sent in by Gary Boos, of Bismark, ND, the computer participant fared much better in winning five matches while losing only one. One match was against Warren Stenberg who was rated 1969 against Chess 4.5's rating of 1600. (Currently Chess 4.6, in its upgraded version, is rated about 2000). "It is interesting to note," writes Gary Boos."That Mr. Stenberg is Professor Warren Stenberg who has co-authored a book which covers the subject of tree searches and who is familiar with computer chess programs. Too bad it didn't help him at Minnesota. It is also interesting to note," Gary adds. "That everyone underestimated the chess-playing ability of Chess 4.5, including its own programmers, David Slate and Larry Atkin." That game between Stenberg and Chess 4.5 is recounted here, together with excellent annotations by Gary Boos.

White Challenger

. . . Gregory Judice, 740 Hemlock Dr., Oradell, NJ 07549 offers this interesting game, with annotations, where he permits Chess Challenger to play White.

Position after Black's Move #10. Like a boxer holding his loose trunks up with one hand Chess Challenger is about to get knocked out of the ring.



White: **Chess Challenger** Black: **G. Judice**

1. P-Q4	P-Q4	
2. N-QB3	N-KB3	
3. N-B3	P-QB4 (a)	
4. PxP	N-QB3	
5. B-B4	P-K3 (b)	
6. B-K3	Q-R4 (c)	
7. P-QN4	QxP	
8. B-Q4	BxP	
9. P-K3 (d)	BxB	
10. NxB (e)	N-K5 ! ! (f)	
11. P-QR3 (g)	QxN ch	
12. K-K2	B-Q2 (h)	
13. P-KB3	NxN ch	
14. PxN	B-N4 ch	
15. Q-Q3	Q-Q7 mate	

(a) Tries to extract power from center of board.
(b) Frees KB and uncovers a B attack on White's pawn.
(c) Pins White's knight and attacks pawn at same time. White should have given up at this point.
(d) Trying to protect the bishop.
(e) Prefers the knight move to the pawns's ?
(f) The key play of the game. This move prevents White's king from protecting his knight.
(g) A desperation move to lure the Black queen out.
(h) Black is now ready to develop his knight attack.

On the Grading of Chess Players

(Although Professor Good confines his remarks here — written in 1955 for the Mathematical Gazette — to human chess players, it seems that a system for mathematically and accurately grading chess-playing computers could also be devised, using the same principles.)

"The purpose of this note is to suggest a system of marking chess players that is both simple to apply and based on a theoretical background. The non-mathematical reader will not need to understand formulae." (For purposes of simplification, they are omitted here.)

"In the British Chess Federation Year Book, 1953-4, pages 39-42, there is an article entitled 'A grading system for British players'. It describes a system that it admits to be open to some objections. At first sight the system looks reasonable and is fairly simple to apply, though of course any system requires a fair amount of calculation if it is to be applied to hundreds of players.

"It is important, not allowing for phenomena like 'triangles', to insist on the *principle of no incentives*, namely that it is not in a player's interest to play one player rather than another, assuming all players to be correctly marked; i.e. we require that the expected score when player *x* plays player *y* must be independent of *y* and must therefore be zero (since *y* could be equal to *x*).

"We cannot insist on a *general* principle of no incentives, where players are not necessarily correctly marked. For it is clear that with any reasonable system of marking, a player who is undermarked will expect to receive faster promotion if he is allowed to show his mettle against strong players. And if he is correctly marked he can expect to find it profitable to play against overmarked opponents. This type of injustice is inevitable and tends to correct itself in the long run, whereas a violation of the special principle of no incentives would lead to permanent incentives favouring unethical behaviour.

"In the next step of the argument it is convenient to avoid the consideration of draws by means of a trick. We can suppose for the moment that if two players draw a game then they play again and again until the first non-draw. A complete sequence of games like this, terminating in a non-draw, can be called a 'modified' chess game. Every modified chess game is either won or lost. We now assume that (in modified chess) the odds of *x* beating *y* times the odds of *y* beating *z* is equal to the odds of *x* beating *z*. This assumption is certainly not accurate, but without a considerable amount of work on analysing the results of many games it would be difficult to find anything more accurate. It should, however, be noticed that if the assumption were found experimentally to be too inac-

curate it would always be possible to go back to the definitions and construct a more satisfactory system.

"If a prodigy who is marked originally as having a chance of 1/100 of beating a master proceeds to win ten consecutive games against different masters, then he should himself be classed as a master or close to one. The parameters suggested here could be agreed or varied by a responsible body. An objection to the system, mentioned in the article, is that it is always profitable to play an opponent whose mark exceeds one's own by more than 500 points, unless the system is modified in an inelegant manner. The publication of the article is stimulating to further thought and the system to be described here is one of the results. It is not open to an objection of the above form.

"The theoretical background rests on one basic principle, and on two assumptions that may not be very accurate for the game of chess. But one could imagine a type of game for which they were accurate and for this type of game the system would be decidedly just. Once this assertion is accepted it seems very reasonable to apply the same system to chess. The system is intended to have the important property that once the players are correctly marked, they will not be expected to deviate much from their correct marks even if their match captains should consistently place them too high or too low in the team.

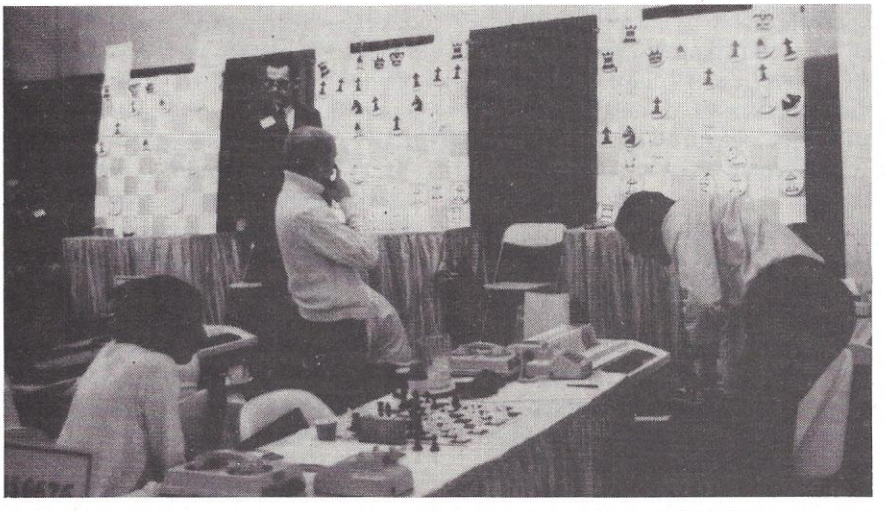
"It will be convenient to distinguish between the terms 'mark' and 'score'. The (correct) mark of a player is to be a real number, x, which is an increasing function of his playing strength. It is true that in practice, triangles exist in which player A tends to beat player B, B to beat C and C to beat A; but since we can hope only to achieve rough justice by means of a simple marking system, it would be splitting hairs to bother about such finer points, and we might as well assume that we can legitimately talk about 'playing strength' as if all players could in principle be well-ordered.

"A 'score' is to be a number added to the current 'mark' of a player as a consequence of the result of a game played. Whatever the strength of a player compared with his opponent, his score is positive if he wins and negative if he loses, and is to be regarded as a fairly small correction to his current mark. We imagine that the players to be considered have various marks at some moment of time, and then are successively corrected as time proceeds and more games are played.

"It might be thought that the distinction between 'marks' and 'scores' is unnecessary, and it is not made in the B.C.F. Year Book. But this distinction does correspond to the way in which we judge people, both in chess-playing and in other abilities. The distinction leads quite naturally to the effect that games played several games ago make only a small contribution to our current estimate of a player's ability. For this reason it becomes unnecessary in principle to introduce an arbitrary period of time during which the games played are relevant to the marks.

"The system described here (relative formulae omitted) is not precisely iterative in the ordinary mathematical sense, but can be expected to converge on the whole, as time passes, to the correct strengths of the players. Games played some games back have less and less effect on the current marks. This property implies that the order in which the games are won is relevant though the two sides may be nearly equal.

(Anyone desiring a complete copy of Prof. I.J. Good's four-page comments, containing *all* relevant mathematical formulae, please contact him at Dept. of Statistics, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061).

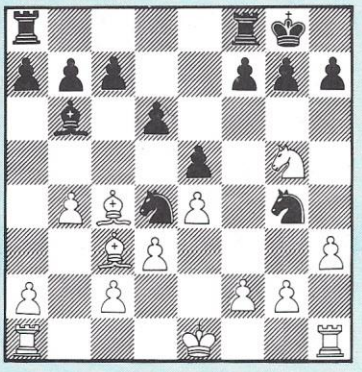


A tense moment during the 9th ACM Chess Tourney as Barend Swets (BS '66'76) anxiously watches the printer, while Tony Marsland (AWIT) waits patiently.

SARGON II!

At the conclusion of the first PENROD MEMORIAL MICROCHESS TOURNAMENT in California, Don Gerue and Russ McNeil wrapped BORIS and CHESS CHALLENGER -10 in swaddling clothes and gingerly carried the two infants to the home of Kathe Spracklen. The strangers were greeted at the door with loud growls by SARGON II, Kathe's newly-created house pet. The dedicatd chess machines were then matched against the microcomputer program and SARGON II proceeded to devour both victims. "It turned out to be a very educational session for SARGON II" comments Don, "because it was heading for the big ACM Computer Chess Tournament in Washington. Kathe had upgraded SARGON from a two-ply search to a three ply search. SARGON was one of two microcomputer programs admitted to the tournament (the other was MIKE, from England.) Playing against BORIS and CC-10, Kathe was able to make some further adjustments in her SARGON program which improved its playing capabilities at Washington. The final finish, at the ACM conference was a 3-way, third-place tie for Sargon II in the field of 12. It was a great victory for microcomputers and their chess programs!" concludes Don. Following is the pre-conference game SARGON II (as Black) played against CHESS CHALLENGER-10 (White).

Position after White's 14th move



White -
CHALLENGER 10 - Level 10

vs.

Black -
SARGON II - 3 Ply

1.	P-K4	P-K4
2.	N-KB3	N-QB3
3.	B-B4	N-B3 (a)
4.	N-B3	B-B4
5.	N-KN5? (b)	0-0
6.	P-Q3	P-Q3
7.	B-Q2? (c)	B-KN5 (d)
8.	N-K2	BxN
9.	QxB	N-Q5
10.	Q-Q	Q-Q2 (e)
11.	P-QN4?	B-N3
12.	B-B3? (f)	Q-N5
13.	QxQ	NxQ
14.	P-KR3 (g) *	NxPch
15.	K-Q1 (h)	NxR
16.	PxN	B-Q5? (i)
17.	BxB	PxB
18.	K-Q2	P-QN4
19.	BxPch? (j)	RxB
20.	NxR	KxN
21.	RxP (k)	P-QR4
22.	R-R1	N-B7 (1)
23.	KxN	PxP
24.	R-R1	P-B4
25.	P-B4	P-B5 (m)
26.	PxP (n)	PxP
27.	P-K5	PxP
28.	R-QN1	RxPch
29.	K-B1	P-N6
30.	PxP	RxP
31.	R-N2	R-N8ch
32.	K-Q2	P-B6ch
33.	K-Q3	PxR
34.	P-K6ch	KxP
35.	P-N5	K-Q4
36.	K-K2	P-N8=Q
37.	P-N6	Q-B8ch
38.	K-Q2	R-N8 mate

Notes to game of CHALLENGER-10 vs SARGON II by Morris Miller. (Additional comments in parentheses, are by Kathe Spracklen, author of SARGON II program.)

(a) The Two Knights Defense. It would be interesting to see a program which could play either White or Black in this line: 4-N-N5, P-Q4; 5-PxP, N-QR4; 6-B-N5ch, P-B3; -7-PxP, PxP; 8-B-K2, P-KR3; 9-N-B3, P-K5 with attack. After its next move CHALLENGER is out of book.

(b) The game has transposed into the Guicco Piano ("quiet game") which can be anything but quiet. CHALLENGER, having White and the first move, should maintain a slight edge by simple development instead of the text. Black could not imitate and would sooner or later have to diverge. Here is where a knowledge of theory and ability to plan strategically would point the way rather than a reliance upon tactics.

(c) Very poor, putting the Bishop on a non-functioning square where it blocks the Queen. B-K3 is best.

(d) Again positional considerations should prevail. SARGON should attempt to nullify the White King's Bishop by 7-. . .N-QR4 and if 8-B-N5, either B-Q2 or P-B3 and an eventual swap of Knight for Bishop with an ultimate liberating P-Q4 for Black.

(e) Avoiding 10-. . .P-KR3; 11-P-KR4, PxN? 12-PxP, N(KB3)-N5, R-R4, etc.

(f) P-QB3 is best.

(g) See diagram. Here SARGON errs. Better is 14-. . .NxKBP; 15-KxN, NxBP dis ch; 16-K-Q2, NxR; 17-RxN and Black has a Pawn more than in the text. But 14-. . .N-KB3 is best.
(SARGON sees winning Rook and Pawn for his Knight at KN5. He can't see that the capturing Knight will become trapped. - KS)

(h) K-Q2 at once.

(i) Bad but if 16-. . .BxP; 17-NxRP, B-K6; 18-P-KN5 and P-N6 wins. But both programs overlook that the Black KR Pawn is en pris.
(Saving the Knight temporarily - KS)

(j) CHALLENGER could still hold at least a draw with 19-B-Q5 and RxN.

(k) As far as CHALLENGER saw, probably. A Pawn ahead and the Knight trapped, but SARGON's next move puts Black on top.
(Still trying to save the Knight. If 22. PxP, RxP; 23 R-R1, RxP ch and the Knight is safe. - KS).

(l) Also a win is 21-. . .PxP; 22-RxN, R-R6; 23-K-B2, P-B4. Now White after running out of Pawn moves must play K-Q2 allowing P-N6 or abandon the QP.
(At the next move SARGON recovers a pawn for a lost Knight and material is even. - KS)

(m) Or 25-. . .R-R6 as in the previous note.
(At the 24th move, SARGON knew that the unopposed Pawn in a Pawn majority should be advanced first. This Pawn push also earns bonus points in the program, for protecting the unopposed Pawn at QN5 - KS)

(n) Black's Pawn roller is too much. If 26-K-N2, P-N6; 27-PxP, P-B6ch; 28-K-N, P-B7ch etc. Or 27-P-KR3, R-R5; 28-Any, P-N5 and the same threat.
(SARGON is happy to straighten out one pair of doubled Pawns, but he's positively thrilled at achieving two connected Pawns and earning lots of bonus points for this maneuvre. - KS)

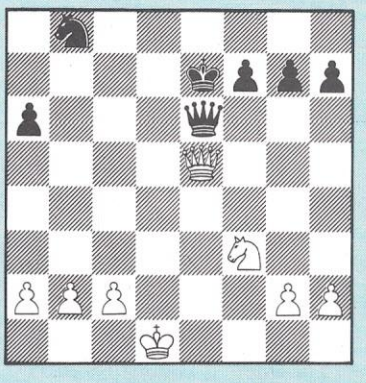
SARGON's endgame play was superior to CHALLENGER's. SARGON's 21st move and its mobilization of the Pawn roller showed its end game play is quite good for a computer.

However, the middle game was a sad exhibition. This game displays the shortcomings of programming which concentrates on tactics to the exclusion of strategic planning.

Recalling Toronto

During the World Computer Chess Tournament at Toronto in August of 1978 when CHESS 4.7 won the world's title from Russia's KAISSA, two programs (BS'66'76 and CHUTE 1.2) that had not had too much luck ran into each other. As is usually the case when the two smallest kids in a gang tangle with each other, a hard fought battle ensued. It ended in a draw. Morris Miller now takes a closer look at these programs to see how the "weaker" ones were faring. In chess one must use the designation of "weak" with some reservation because today's master is defeated by tomorrow's Class C player. An accepted code in all sports is that only champions "fall." The opponents are "defeated" or are "beaten" or are "repulsed." As a respite from watching the many computer-chess champions fall regularly at tournaments it is nice to observe this little "street fight" taking place in a corner of the computer room. Mike Valenti, of Toronto, Canada, disappointed in the past performances of CHUTE 1.2, tells us that he is abandoning open tournament competition for awhile. When he brings his program up to higher level he plans to be back. Barend Swets, also, has had problems with his program. Unable to have continuous access to a computer, Barend upgrades his program after a tournament which he says is slow but steady progress. His enthusiasm for computer chess remains undiminished after almost 15 years association with it. That scrappy little game BS-'66 '76 played against CHUTE 1.2 follows:

Position after Black's 27th move



White- *BS '66 '76* Black- *CHUTE 1.2*

1. P-Q4	P-Q4	20. KxB ?	B-Q3
2. P-K4 (a)	PxP	21. N-B3	R-B
3. N-QB3	N-KB3	22. Q-N7ch	B-B2
4. P-KB3	PxP	23. Q-Q5ch	K-K1
5. QxP	QxP	24. BxB	RxB
6. B-K3	Q-QN5	25. R-K1ch	R-K2
7. 0-0-0	B-N5	26. RxRch	KxR
8. N-N5	N-R3	27. Q-K5ch	Q-K3
9. QxP	BxR	28. QxN	Q-Q4ch
10. N-Q6ch	QxN	29. K-B1	QxP
11. B-N5ch	P-B3 (b)	30. Q-N7 ch?	K-B3
12. BxPch	N-Q2	31. Q-B6ch	Q-K3 (d)
13. QxRch	N-N1	32. Q-B3ch	K-N3
14. B-QN5?	P-QR3	33. N-R4ch	K-R4
15. BxN ch	KxB	34. Q-B3ch	KxN
16. Q-N7ch	K-K3	35. Q-B4ch	K-R4
17. Q-K4ch	K-Q2	36. P-N4ch	QxP
18. B-B4 (c)	P-K4	37. QxPch	K-R3
19. BxP	Q-R3ch	38. Q-B1	Q-N4ch
		39. K-N1	Q-QR4
		40. Q-R3ch	Q-KR4
		41. Q-K6ch	Q-N3
		42. Q-K3ch	Q-N4
		43. Q-K6ch	Q-B3
		44. Q-R3ch	K-N3
		45. Q-N4ch	K-B2
		46. Q-B4ch	K-N3
		47. Q-K4ch	K-R3
		48. P-QN4	Q-B8ch
		49. K-R2	Q-B2ch
		50. K-R3	Q-B3
		51. Q-K3ch	K-N3
		52. Q-Q3ch	K-R3
		53. Q-R3ch	K-N3
		54. K-N3	Q-B2ch
		55. K-R3	Q-B5
		56. Q-N3ch?	K-B2
		Draw declared.	

(a) A wild opening, obviously hoping to take Black out of the books.

(b) An unfortunate necessity because if instead N-Q2; 12 QxRch, N-N; 13. BxNch winning the unprotected Knight of N1 if the Bishop is captured. The text allows the Queen to protect the Knight.

(c) It is this position White has aimed for since the Black Queen is "overloaded," meaning it has to protect two points, the Knight as well as the Bishop. However, Black can now play 18 . . . Q-QB3; 19. Q-Q3ch, K-B; 20. QxB, QxNP; 21. N-K2, N-B3, etc., with an interesting game and chances for both sides.

(d) Evidently neither of the warriors has been programmed to detect that White has an easy win by exchanging Queens. –M.M.

Valenti Chess Program – Part IX

This complete dissertation by Mike Valenti on how to write a computer chess program is presented in monthly sections as a guide for those wishing to write their own programs. Although designed to be run on a large computer, this program with proper modifications can serve also as a model in writing a chess program for smaller memory-systems — even the microcomputer. This program is written in BPL (modified XPL), but it can be written in other languages as well — with proper transitions.

Using the HEURISTICS routine, a re-evaluation of an exchange is done on the to-square of a proposed move. Most of the information, pre-collected before the heuristics are applied, is tabulated below in Figure 2.

After the heuristics have all been applied, a special heuristic-heuristic looks at how many heuristics liked a move (had positive values) and how many heuristics disliked it (had negative values). The move's scores are then adjusted. Sorted move lists are then passed to the look-ahead routine.

The Location Table (Fig. 1) supplies information about each square on the board, in the bit positions of a halfword for each square on the board.

Bit position from right	Name given to bit position	Bit Function
1	CENTRE_4	Center 4 squares
2	EDGE_PAWN	Squares on edge of board in castling positions
3	CASTLE_PAWN	Pawn squares in front of castling positions
4	ENEMY_KING	Squares around enemy king
5	ENEMY_PP	Squares of enemy passed pawns
6	ENEMY_PPF	Squares in front of enemy passed pawns
7	PINNED_ENEMY	Squares with enemy pieces pinned on them
8	OWN_KING	Squares around own king

Figure 1 Location Table

Chess Position Data Structure

(Items in this structure are referenced with pointer variables)

CDS.LENGTH	Length of data structure
CDS.LASTMF	From square of last move
CDS.LASTMT	To square of last move
CDS.BVP	Pointer to board vector
CDS.PIECEP(32)	32 pointers to piece data
CDS.SQUAREP(64)	64 pointers to square data
CDS.DATA(x)	Rest of piece and square data
PDS.PCODE	Piece code for this piece #
PDS.SQOCC	Square occupied by this piece
PDS.DEVAL	Developmental value
PDS.#AD	# squares hit by this piece
PDS.SQL(x)	List of squares hit, square# = square# + 0 if no piece on it, 100 if defending it, 200 if attacking it
SDS.PONSQ	Piece # on this square
SDS.SVALUE	Value of this square
SDS.WAD	# of white hitting this square
SDS.BAD	# of blacks hitting this square
SDS.HIT1	# of indirectly hitting pcs with one piece intervening
SDS.HIT2	# of indirectly hitting pcs with 2 pieces intervening
SDS.WBL(x)	List of whites (piece numbers), List of blacks (piece numbers), Pairs of indirect hitters with one piece intervening, Triples of indirect hitters with 2 pieces intervening.

Figure 2 Data available to the heuristics

The information is tested by shifting the item in the table to the right, the required number of bits.

PINNED "TABLE"

This establishes the value of a pinned piece to the squares between the pined piece and the pinning piece, the square the piece is pinned on, and the squares between it and the piece it is pinned against. (A value is derived for each of the 64 squares.)

Piece Value Table

Pawn	=	1
Passed Pawn	=	2
Knight	=	3
Bishop	=	3
Rook	=	5
Queen	=	9
King	=	14

(These values are used in exchange evaluations. However, the Kings are not considered to be tradeable pieces.)

INTERPOSE "TABLE"

This establishes a value for each of the 64 squares of a machine's piece being attacked, to the squares between it and its attacker.

The "developmental value" referred to in the heuristics (to be fully explained later) refers to the following: It is the sum of the values of all the squares that the piece can go to, attack, or defend; plus the values of any pieces on those squares (friendly or enemy). No credit is given for defending your own king, or the square it occupies. The parameters (in the upcoming move-heuristic table) are the numerical weights that will be assigned to each heuristic. In some cases, these descriptions only partially describe the heuristic. (The program listing will show the exact implementation.) The "maximum parameter facter" that will be mentioned in the program, is equal to the largest parameter (in this case 15), times parameter #14 ("material balance" heuristic, also 15), and in this case the product equals 225. This can be conceptually considered as the value of a pawn (not a passed pawn) when looking at the total value assigned to a move.

Attack and defense lists created in PLAUSIBILITY_ANALYSIS:

AL_ATTED	Square # being attacked
AL_ATTING	Square # attacking
AL_DA	Damaging attack flag
AL_MA	Multiple attack flag
AL_#ATTING	# of pieces attacking
DL_ATTED	Square # being attacked
DL_ATTING	Square # attacking
DL_DA	Damaging attack flag
DL_MA	Multiple attack flag
DL_LOSS	Loss in exchange

Attack list (AL) for all enemy pieces attacked
Defense list (DL) for machine pieces attacked

These variables are applied to all the heuristics:

FROM_PIECE#	# of piece on from-square for move being evaluated
FROM_PC_VALUE	Value of this piece
TO_PC_VALUE	Value of this piece on the to-square (may now be passed pawn)
FROM_SQ#	Square number of from-square
TO_SQ#	Square number of to-square
MOVE_TYPE	Code for type of move
PROPOSED_CAPTURE#	Piece number of captured piece
PROPOSED_CAPTURE_CODE	Piece code of above
PROPOSED_CAPTURE_VALUE	Value of captured piece
BOARD_VECTOR (64)	8 by 8 board of piece codes after move made
BP@BD.VECTOR (64)	8 by 8 board of piece codes before move made
SQUARE# (32)	Square # of a piece #
PIECE # (64)	Piece number on a square
PAWN_MOVED, KNIGHT_MOVED, BISHOP_MOVED, KING NM_MOVED, ROOK_MOVED, QUEEN_MOVED, KING_MOVED, KING_MOVED, ROOKNM_MOVED	Flags for the type of piece that was moved (only one of these flags can be true)
TURN	Side-to-move indicator
P_ATTED, P_ATTING, PDA, PMA, WASDA, NO_ATTACKERS	Attack evaluation data for the piece on its new square
PTO(x)	Lists of all squares hit from to-square
P#ATT, PROP_ATTACKING (x)	Number and list of squares attacked
P#DEF, PROP_DEFENDING (x)	Number and list of squares defended
P#GOTO, PROP_GOTO	Number and list of possible empty to-squares
PROPOSED_CAPTURE_DEVAL	Developmental value of captured piece
OLD_DEVELOPMENTAL_VALUE	Dev. value on from-square
NEW_DEVELOPMENTAL_VALUE	Dev. value on to-square
PROPOSED_LOSS	Loss in exchange
NEW_DEFENDERS	# of defenders on to-square
EN_PASSANT_RETAKE	Flag indicating if enemy can retake this piece en-passant
START_OF_EXCHANGE	Flag if this move starts an exchange of pieces
ALREADY_CASTLED	Flag if side-to-move has castled
CANT_CASTLE	Flag for side-to-move can't castle
BN_NOT_MOVED	Flag indicating that not all bishops and knights for the side-to-move, have moved once
Q_HASNT_MOVED	Flag that queen for side-to-move has not moved
PP_COLUMN (8)	Flags for each column; true if passed pawn on it
OPEN_COLUMN (8)	Flags for each column; true if column is open
#PAWNS_ON_COLUMN (8)	Number of pawns of side-to-move on a column
ENEMY_PASSED_PAWNS	Flag indicating if any enemy passed pawns on the board
KINGS_NEW_DEV_VALUE	Dev. value of king, if one was moved, on the to-square
KINGS_OLD_DEV_VALUE	Dev. value of king, if one was moved, on the from-square

(The next installment will describe "Look-Ahead.")

Computer Checkers

(Checker annotations by Richard L. Fortman,
Games Editor of American Checker Federation)

Three Unusual Variations on Checkers

. . . Arthur H. Olsen, 7123 4th Avenue, Apt. B9, Brooklyn, NY 11209, writes about three different checker games which could be of interest to computer-checker programmers. "There are three types of checker games – straight checkers, pool checkers and 100-square international checkers," he says. "Pool checkers would be more difficult than straight checkers for a computer to play. In 'Pool Checkers,' the 'long-distance' king has more choices of moves than the 'short distance' king of straight checkers. On the other hand, fewer moves are required to get from one square to another distant square. The computer might find that more of a tacky problem than moving a rook in chess. 'Straight Checkers' is the game formerly known as English draughts. It is the well-known game currently being played by millions of American checker players. 'Pool Checkers' is known also as 'Spanish Pool Checkers.' In the 'Pool' variation, a single checker may jump forward or backward to knock off opposing pieces. When a checker reaches the king's rank but is able to immediately jump backward and capture an enemy, it must do so and cannot become king for another move or so. It becomes king when its progress terminates at the last rank. As king, a piece can move forward on a diagonal and any number of squares, can jump any opposing piece on that diagonal (capturing it) and land on any free square beyond the piece except that it must continue capturing if it can, even if it has to take a right-angle turn onto another diagonal. If it lands

on a single unoccupied square it can stay there. If the king leaps forward more than one unoccupied square it *must* land on a square from where it can make another jump. If there is no such square from which to make a capture, the king can land anywhere. When the end game reaches a position of three kings against one, and if there are no other checkers on the board, then a draw is declared provided the lone king can make 13 legal moves against the three kings. It is curious to note that in this end-game situation a win is possible only if the side with three kings has possession of the center diagonal of the board which runs from left to right. 'International Checkers,' popular in foreign countries, is like pool checkers except that each player has 20 pieces and the game is played on a 100-square board. When computer programmers tire of playing chess, let them try their circuit boards on this International Checker game. They might develop a new respect for the game of 'checkers.' "

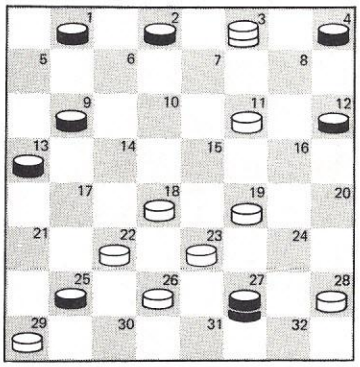
Thoughts From Fortman

. . . Dick Fortman has finished evaluating Dr. Samuels' checker program on the Video Brain and will be forwarding some of the games. "Although it had a certain entertainment value," he writes, "I found it inferior to Checker Challenger."

"Electronic games – both basic and sophisticated – were very popular during the past Christmas season" continues Fortman, "and many stores reported that they could not meet the demand. This is a great boost for the board games.

"Although straight checkers has long been regarded as intellectually inferior to chess, it is a matter of record that neither game has been totally mastered by the finest minds. Even the present world checker-title holder, Marion Tinsley, of Tallahassee, Florida, (whose stake match still awaits a challenge from any computer in the world) has lost games in tourney competition – although those losses have been rare. One noted writer has compared the games of chess and checkers to two wells – the depths of which have never been fully plumbed. Therefore, no one can say which is the deeper."

. . . The following position, occurred in an actual game between CHECKER CHALLENGER and a human. White to play and win.



"Although white is a piece ahead, here," says Dick Fortman, "black has one king behind the single white pieces in the middle of the board and threatens to crown another king. But white has a forced "compound shot' or stroke with a kick-back at the end which wins at once. This problem was solved at level 4 of Chess Challenger and required three minutes, 20 seconds to find the initial key move." (Solution at lower right.)

Notes on the Video Brain Checker Program by a User

. . . The computerized Video Brain plays checkers by means of a joystick manipulator which moves a blinking cursor on the screen indicating the next checker move to be made. Its typewriter-like keyboard consists of 28 keys with upper and lower sets of characters plus 8 function keys. It connects to the home TV either in Black and White or Color by means of pin connector switches, and interrupts the TV antenna with its own signals. Video Brain, and Dr. Samuel's checker program, lets you choose from four increasingly difficult levels of checker play, from "A" to "D". The program, by means of a usage displayed on the TV screen, asks you to choose your playing level and also gives you the choice of playing either Black or White. The higher you go (from "A" to "D" in difficulty) the more tree-searching takes place in the computer program. "A" will look ahead at least 3 moves while "D" will examine a minimum of six moves. The small computer and its cartridge selections (small programmed integrated-circuit boards) sells for about $350 (a recent reduction from its $550 price.) The unit is self contained and there is no need to buy extra peripherals. Of great interest, now, is a new cartridge developed by the company. When inserted into the slot of the Video Brain, it allows you to use the machine as a computer in which you can prepare your own programs and store them for future use. This new feature makes the Video Brain a nice gameplaying machine, as well as the lowest-price microcomputer on the market. More information can be obtained from Video Brain Computer Company, 150 South Wolfe Road, Sunnyvale, CA 94086.

On the Duke Checker Program

. . ."Until 1950, computers were used almost exclusively for numerical tasks such as computing tables of trigonometric functions. By the early 1950's, computing capabilities had increased enormously and the notion arose that computers could also be applied to non-mathematical, or logical problems. In 1952, C.S. Strachey described a program which could play a complete game of checkers. The emergence of Strachey's program, and others which attempt solution of problems ordinarily thought to require intelligence, gave birth to the field of Artificial Intelligence. Within a few years, Dr. Arthur Samuel had developed a checker-playing program which played excellent checkers and could beat all but the very best players. The program used numerous artificial intelligence techniques and was such an outstanding success that many computer experts predicted a computer would some day become world champion in such games as checkers and chess." (From Tom Truscott's report on the development of Duke University's checker-playing program.)

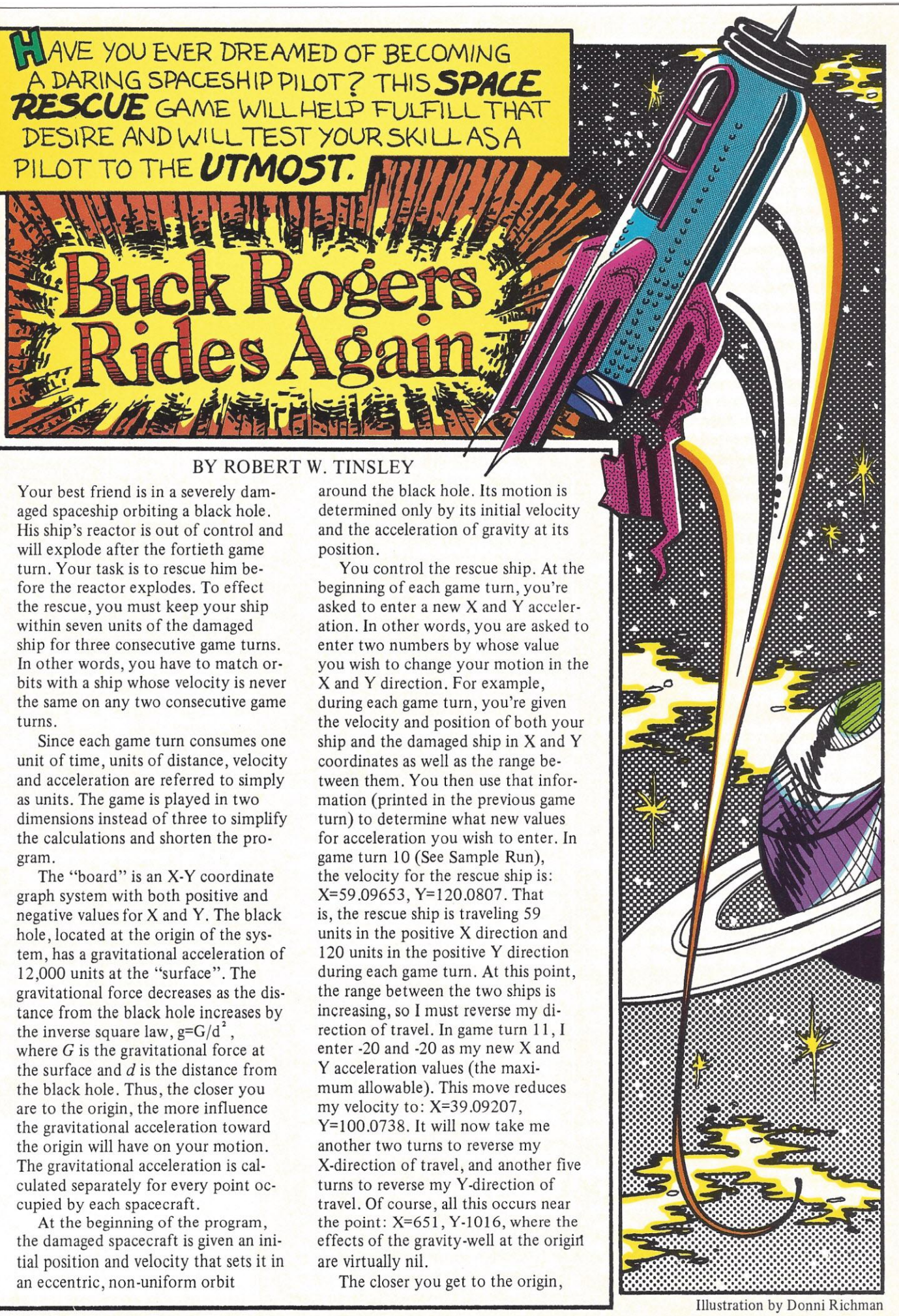
Answer to checker end game problem:

White to move and win

Black	White
1.	11-8
2. 4-11	18-14
3. 9-18	22-8
4. 27-18	29-15 (White Wins)

HAVE YOU EVER DREAMED OF BECOMING A DARING SPACESHIP PILOT? THIS **SPACE RESCUE** GAME WILL HELP FULFILL THAT DESIRE AND WILL TEST YOUR SKILL AS A PILOT TO THE **UTMOST.**

Buck Rogers Rides Again



BY ROBERT W. TINSLEY

Your best friend is in a severely damaged spaceship orbiting a black hole. His ship's reactor is out of control and will explode after the fortieth game turn. Your task is to rescue him before the reactor explodes. To effect the rescue, you must keep your ship within seven units of the damaged ship for three consecutive game turns. In other words, you have to match orbits with a ship whose velocity is never the same on any two consecutive game turns.

Since each game turn consumes one unit of time, units of distance, velocity and acceleration are referred to simply as units. The game is played in two dimensions instead of three to simplify the calculations and shorten the program.

The "board" is an X-Y coordinate graph system with both positive and negative values for X and Y. The black hole, located at the origin of the system, has a gravitational acceleration of 12,000 units at the "surface". The gravitational force decreases as the distance from the black hole increases by the inverse square law, $g=G/d^2$, where G is the gravitational force at the surface and d is the distance from the black hole. Thus, the closer you are to the origin, the more influence the gravitational acceleration toward the origin will have on your motion. The gravitational acceleration is calculated separately for every point occupied by each spacecraft.

At the beginning of the program, the damaged spacecraft is given an initial position and velocity that sets it in an eccentric, non-uniform orbit around the black hole. Its motion is determined only by its initial velocity and the acceleration of gravity at its position.

You control the rescue ship. At the beginning of each game turn, you're asked to enter a new X and Y acceleration. In other words, you are asked to enter two numbers by whose value you wish to change your motion in the X and Y direction. For example, during each game turn, you're given the velocity and position of both your ship and the damaged ship in X and Y coordinates as well as the range between them. You then use that information (printed in the previous game turn) to determine what new values for acceleration you wish to enter. In game turn 10 (See Sample Run), the velocity for the rescue ship is: X=59.09653, Y=120.0807. That is, the rescue ship is traveling 59 units in the positive X direction and 120 units in the positive Y direction during each game turn. At this point, the range between the two ships is increasing, so I must reverse my direction of travel. In game turn 11, I enter -20 and -20 as my new X and Y acceleration values (the maximum allowable). This move reduces my velocity to: X=39.09207, Y=100.0738. It will now take me another two turns to reverse my X-direction of travel, and another five turns to reverse my Y-direction of travel. Of course, all this occurs near the point: X=651, Y-1016, where the effects of the gravity-well at the origin are virtually nil.

The closer you get to the origin,

Illustration by Donni Richman

however, the less effect that twenty units of acceleration has on your motion. For instance, in game turn 4, my position is: X= - 3.3, Y= - 4.8. In game turn 5, I enter a -20, -20 as my new X and Y acceleration. This command should have the effect of moving my ship down and to the left, away from the origin. But, because I'm so close to the origin, the pull of gravity totally cancels my acceleration – and then some! In game turn 5, in spite of my negative acceleration, my velocity is now: X=159, Y=220. And my new position is: X=156, Y=215. The range between the ships went from 36.6 units in game turn 4, to 301.5 units in game turn 5. I am now off on a trip that will take me thirty turns to return to within a reasonable distance of the damaged ship – too late to effect a rescue.

Of course, this program does not give a true representation of motion in space; but then, it was never intended to. Such a program would be at least three times as long as this one and be much more complicated to run. This program was designed to be a short, simple way of indulging a fantasy on a home computer by giving a reasonable approximation of the actions of a spacecraft in orbit, and it fills that bill very nicely.

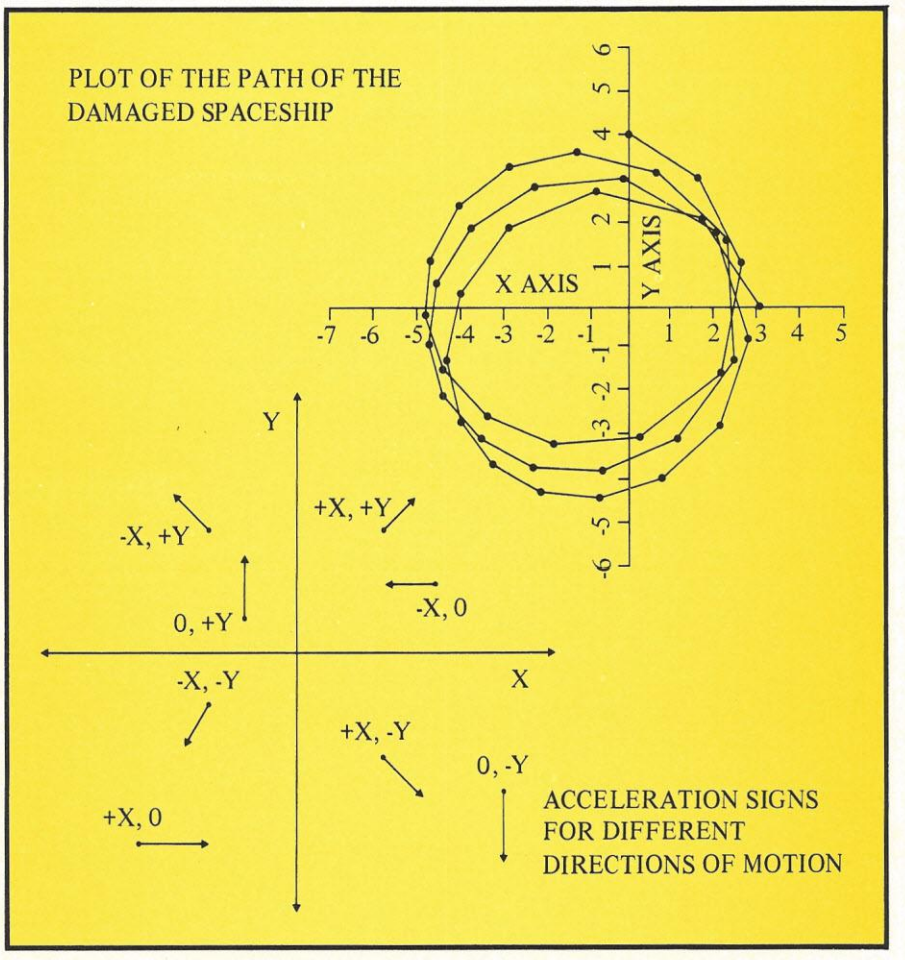
If you would like a little variety in the path the damaged ship takes around the black hole, simply insert the following statements:

```
ØØØ31 PRINT "ENTER DATE
       AND TIME."
ØØØ32 INPUT N1,N2
```

(These statements seed the random number generator that will choose between five different starting positions and velocities for the damaged ship. Some of these will put the ship in tighter orbits where the velocities will be high, and others put it in larger orbits with lower velocities. The date and time should consist only of numbers, i.e.: June 28, 1978, becomes . 062878; and 9:05 a.m. becomes 0905 or 09.05.)

```
ØØØ33 LET N3=N1*N2
ØØØ34 LET N3=RND(N3)
ØØØ35 LET M=INT(RND*5+1)

ØØ181 IF M=1 THEN 19Ø
ØØ182 IF M=2 THEN 222
```



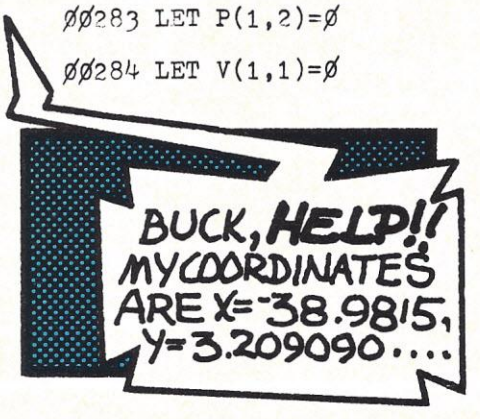

```
ØØ183 IF M=3 THEN 282
ØØ184 IF M=4 THEN 3Ø2
ØØ185 IF M=5 THEN 312

ØØ221 GOTO 23Ø
ØØ222 LET P(1,1)=Ø
ØØ223 LET P(1,2)=5Ø
ØØ224 LET V(1,1)=-15.49
ØØ225 LET V(1,2)=Ø
ØØ226 GOTO 23Ø

ØØ281 GOTO 29Ø
ØØ282 LET P(1,1)=-15
ØØ283 LET P(1,2)=Ø
ØØ284 LET V(1,1)=Ø
ØØ285 LET V(1,2)=-28.28
ØØ286 GOTO 23Ø

ØØ3Ø1 GOTO 31Ø
ØØ3Ø2 LET P(1,1)=Ø
ØØ3Ø3 LET P(1,2)=-35
ØØ3Ø4 LET V(1,1)=18.52
ØØ3Ø5 LET V(1,2)=Ø
ØØ3Ø6 GOTO 23Ø

ØØ311 GOTO 32Ø
ØØ312 LET P(1,1)=75
ØØ313 LET P(1,2)=Ø
ØØ314 LET V(1,1)=Ø
ØØ315 LET V(1,2)=12.65
ØØ316 GOTO 23Ø
```



The subprograms of this game have been designed so that they may be lifted out as is and used to control the motion of spacecraft in other space games that you may wish to design yourself. Who knows? You may become another Buck Rogers. □

Space Rescue Program Listing

```
00010 REM SPACE RESCUE PROGRAM
00020 DIM P(2,2),V(2,2),G(2,4),A(2,2),R(2,2),C(2),A$(9),B$(9),C$(9)
00030 DIM D$(11),E$(12)
00040 PRINT"YOUR BEST FRIEND IS IN A SEVERELY DAMAGED SPACESHIP"
00050 PRINT"ORBITING AROUND A LARGE SUN.  THE SHIP'S REACTOR IS OUT OF"
00060 PRINT"CONTROL.  YOU HAVE 40 GAME TURNS TO RESCUE HIM BEFORE THE"
00070 PRINT"REACTOR EXPLODES.  TO RESCUE HIM, YOU MUST STAY WITHIN 7"
00080 PRINT"UNITS OF HIS SHIP FOR 3 CONSECUTIVE GAME TURNS.  YOU ARE"
00090 PRINT"LIMITED TO AN ACCELERATION OF + OR - 20.  GOOD LUCK!"
00100 PRINT"YOU'LL NEED IT!!"
00110 REM SET INITIAL VALUES
00120 REM FIRST SUBSCRIPT REFERS TO EITHER THE DAMAGED SHIP (1) OR THE
00130 REM RESCUE SHIP (2).  THE SECOND SUBSCRIPT REFERS TO THE X
00140 REM (1) OR Y (2) POSITION.  G(1,4) IS THE GRAVITY OF THE SUN.
00150 LET G(1,4)=12000
00160 LET N=0
00170 LET A$="YES"
00180 LET P(1,1)=30
00190 LET B$="NO"
00200 LET R(1,2)=0
00210 LET R(2,1)=0
00220 LET P(2,2)=110
00230 LET V(1,1)=0
00240 LET V(1,2)=20
00250 LET V(2,1)=25
00260 LET V(2,2)=0
00270 LET A(1,1)=0
00280 LET A(1,2)=0
00290 LET D$="RESCUE SHIP"
00300 LET E$="DAMAGED SHIP"
00310 REM BEGIN THE GAME
00320 FOR K=1 TO 40
00330 PRINT"GAME TURN";K
00340 GOSUB530
00350 GOSUB590
00360 GOSUB690
00370 GOSUB840
00380 GOSUB970
00390 GOSUB1090
00400 IFD<=7THEN420
00410 GOTO450
00420 LET N=N+1
00430 IFN=3THEN1230
00440 GOTO460
00450 LET N=0
00460 NEXT K
00470 PRINT"TOO BAD, YOUR FRIEND JUST WENT UP IN A BALL OF FIRE."
00480 PRINT"WOULD YOU LIKE TO TRY AGAIN?"
00490 INPUT C$
00500 IFC$=A$THEN10
00510 GOTO1260
00520 STOP
00530 REM COMPUTE VALUE OF G AT POINT P
00540 FOR I=1 TO 2
00550 LET C(I)=P(I,1)↑2+P(I,2)↑2
00560 LET G(I,3)=G(1,4)/C(I)
00570 NEXT I
00580 RETURN
00590 REM COMPUTE VECTOR VALUES OF G AT POINT P
00600 FOR I=1 TO 2
00610 FOR J=1 TO 2
00620 LET G(I,J)=SQR(P(I,J)↑2/C(I))*G(I,3)
00630 IFP(I,J)>0THEN650
00640 GOTO660
00650 LET G(I,J)=-1*G(I,J)
00660 NEXT J
00670 NEXT I
00680 RETURN
00690 REM ACCELERATION VECTORS
00700 PRINT D$;", ENTER NEW X AND Y ACCELERATION."
00710 INPUT B,E
00720 IFB>20THEN770
00730 IFB<-20THEN790
00740 IFE>20THEN770
00750 IFE<-20THEN790
00760 GOTO810
00770 PRINT"YOUR ACCELERATION IS TOO LARGE.  TRY AGAIN."
00780 GOTO700
00790 PRINT"YOUR ACCELERATION IS TOO SMALL.  TRY AGAIN."
00800 GOTO700
00810 LET A(2,1)=B
00820 LET A(2,2)=E
00830 RETURN
00840 REM COMPUTE NEW VELOCITY VECTORS
00850 FOR I=1 TO 2
00860 FOR J=1 TO 2
00870 LET R(I,J)=V(I,J)+G(I,J)+A(I,J)
00880 LET V(I,J)=R(I,J)
00890 NEXT J
00900 IFI=1THEN920
00910 IFI=2THEN940
00920 PRINT"VELOCITY FOR THE ";E$;" IS:  X=";V(I,1);"Y=";V(I,2)
00930 GOTO950
00940 PRINT"VELOCITY FOR THE ";D$;" IS:  X=";V(I,1);"Y=";V(I,2)
00950 NEXT I
00960 RETURN
00970 REM COMPUTE NEW POSITIONS
00980 FOR I=1 TO 2
00990 FOR J=1 TO 2
01000 LET P(I,J)=R(I,J)+P(I,J)
01010 NEXT J
01020 IFI=1THEN1040
01030 IFI=2THEN1060
01040 PRINT"NEW POSITION FOR THE ";E$;" IS:  X=";P(I,1);"Y=";P(I,2)
01050 GOTO1070
01060 PRINT"NEW POSITION FOR THE ";D$;" IS:  X=";P(I,1);"Y=";P(I,2)
01070 NEXT I
01080 RETURN
01090 REM COMPARE POSITIONS
01100 IFP(1,1)<P(2,1)THEN1130
01110 LET X=P(1,1)-P(2,1)
01120 GOTO1140
01130 LET X=P(2,1)-P(1,1)
01140 IFP(1,2)<P(2,2)THEN1170
01150 LET F=P(1,2)-P(2,2)
01160 GOTO1180
01170 LET F=P(2,2)-P(1,2)
01180 LET S=F↑2+X↑2
01190 LET D=SQR(S)
01200 PRINT
01210 PRINT"RANGE IS";D
01220 RETURN
01230 PRINT"CONGRATULATIONS!  YOU HAVE SAVED YOUR FRIEND!  YOU'RE"
01240 PRINT"QUITE A PILOT!!"
01250 GOTO480
01260 END
EDIT
```

Sample Run

```
     RUN
YOUR BEST FRIEND IS IN A SEVERELY DAMAGED SPACESHIP
ORBITING AROUND A LARGE SUN.  THE SHIP'S REACTOR IS OUT OF
CONTROL.  YOU HAVE 40 GAME TURNS TO RESCUE HIM BEFORE THE
REACTOR EXPLODES.  TO RESCUE HIM, YOU MUST STAY WITHIN 7
UNITS OF HIS SHIP FOR 3 CONSECUTIVE GAME TURNS.  YOU ARE
LIMITED TO AN ACCELERATION OF + OR - 20.  GOOD LUCK!
YOU'LL NEED IT!!
GAME TURN 1
RESCUE SHIP, ENTER NEW X AND Y ACCELERATION.
  ?  0,0
VELOCITY FOR THE DAMAGED SHIP IS:  X=-13.33333   Y= 20
VELOCITY FOR THE RESCUE SHIP IS:  X= 25   Y=-.9917355
NEW POSITION FOR THE DAMAGED SHIP IS:  X= 16.66666   Y= 20
NEW POSITION FOR THE RESCUE SHIP IS:  X= 25   Y= 109.0083

RANGE IS 89.39742
GAME TURN 2
RESCUE SHIP, ENTER NEW X AND Y ACCELERATION.
  ?  -20,-20
VELOCITY FOR THE DAMAGED SHIP IS:  X=-24.66774   Y= 6.398696
VELOCITY FOR THE RESCUE SHIP IS:  X= 4.785538   Y=-21.92685
NEW POSITION FOR THE DAMAGED SHIP IS:  X=-8.001083   Y= 26.39868
NEW POSITION FOR THE RESCUE SHIP IS:  X= 29.78554   Y= 87.08141

RANGE IS 71.48576
GAME TURN 3
RESCUE SHIP, ENTER NEW X AND Y ACCELERATION.
  ?  -20,-20
VELOCITY FOR THE DAMAGED SHIP IS:  X=-20.09335   Y=-8.693966
VELOCITY FOR THE RESCUE SHIP IS:  X=-15.67296   Y=-43.26730
NEW POSITION FOR THE DAMAGED SHIP IS:  X=-28.09444   Y= 17.70471
NEW POSITION FOR THE RESCUE SHIP IS:  X= 14.11258   Y= 43.81410

RANGE IS 49.62993
GAME TURN 4
RESCUE SHIP, ENTER NEW X AND Y ACCELERATION.
  ?  0,0
VELOCITY FOR THE DAMAGED SHIP IS:  X=-10.88709   Y=-14.49562
VELOCITY FOR THE RESCUE SHIP IS:  X=-17.40932   Y=-48.65804
NEW POSITION FOR THE DAMAGED SHIP IS:  X=-38.98152   Y= 3.209090
NEW POSITION FOR THE RESCUE SHIP IS:  X=-3.296737   Y=-4.843933

RANGE IS 36.58215
GAME TURN 5
RESCUE SHIP, ENTER NEW X AND Y ACCELERATION.
  ?  -20,-20
VELOCITY FOR THE DAMAGED SHIP IS:  X=-3.069664   Y=-15.13918
VELOCITY FOR THE RESCUE SHIP IS:  X= 159.2496   Y= 220.2951
NEW POSITION FOR THE DAMAGED SHIP IS:  X=-42.05118   Y=-11.93009
NEW POSITION FOR THE RESCUE SHIP IS:  X= 155.9529   Y= 215.4512
```

```
RANGE IS 1114.518
GAME TURN 10
RESCUE SHIP, ENTER NEW X AND Y ACCELERATION.
  ?  -20,-20
VELOCITY FOR THE DAMAGED SHIP IS:  X= 14.42874   Y= 4.520331
VELOCITY FOR THE RESCUE SHIP IS:  X= 59.89653   Y= 120.0807
NEW POSITION FOR THE DAMAGED SHIP IS:  X= 7.542238   Y=-39.22067
NEW POSITION FOR THE RESCUE SHIP IS:  X= 651.5349   Y= 1016

RANGE IS 1236.210
GAME TURN 11
RESCUE SHIP, ENTER NEW X AND Y ACCELERATION.
  ?  -20,-20
VELOCITY FOR THE DAMAGED SHIP IS:  X= 13.00811   Y= 11.90780
VELOCITY FOR THE RESCUE SHIP IS:  X= 39.09207   Y= 100.0738
NEW POSITION FOR THE DAMAGED SHIP IS:  X= 28.55034   Y=-27.31287
NEW POSITION FOR THE RESCUE SHIP IS:  X= 690.6270   Y= 1116.073
```

```
RANGE IS 200.6388
GAME TURN 40
RESCUE SHIP, ENTER NEW X AND Y ACCELERATION.
  ?  -20,20
VELOCITY FOR THE DAMAGED SHIP IS:  X=-15.36202   Y= 1.950270
VELOCITY FOR THE RESCUE SHIP IS:  X=-16.86662   Y= 7.219022
NEW POSITION FOR THE DAMAGED SHIP IS:  X=-15.04421   Y= 43.96681
NEW POSITION FOR THE RESCUE SHIP IS:  X= 8.327301   Y=-152.8543

RANGE IS 195.2251
TOO BAD, YOUR FRIEND JUST WENT UP IN A BALL OF FIRE.
WOULD YOU LIKE TO TRY AGAIN?
  ?  "NO"$+
EDIT
```

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The 9th Annual ACM Chess Tournament in Washington, D.C.

As in ancient Rome, when armor-clad gladiators were sent into the Coliseum in a fight to the death with similarly-clad opponents, chess-playing computers, protected by heavy steel shells, are now clashing with each other on a regularly scheduled, but more civilized, basis. One such struggle, recounted below, took place in Washington, D.C., on December 3rd to 5th, 1978, during the 9th Annual Computer Chess Tournament sponsored by the ACM.

BY HARRY SHERSHOW

For the second time in 11 years the annual conference of the ACM (Association for Computing Machinery) was held at the Sheraton Park Hotel in Washington, D.C., just two miles from the White House. During the conference, the 9th Annual Computer Chess Tournament, sponsored by ACM, was conducted and Ken Thompson of Bell Labs, NJ emerged the winner with his BELLE program.

The basement of the Sheraton Park is a large, unfurnished area. It consists of two great convention halls divided on the inside by free-standing fabric screens and entered separately by pairs of double doors. One of the rooms has a long 40-foot raised stage, and on special occasions the screens can be taken down and the two rooms joined together as one large convention hall. Organizational meetings are held here, as well as lectures, dances, weddings and bar mitzvahs. Many a daughter of U.S. Congressman has had her wedding reception here. Now, for the chess tourney, the halls are separated by the screens to form two smaller halls. One hall is an exhibit area for a few publishers; the other has been set up for the 12-player chess match scheduled to run in four rounds from Sunday afternoon, Dec. 3rd to Tuesday night, Dec. 5th.

Six, large, upright chess-display boards, their magnetic-based chess pieces arrayed in proper pre-game formation, have been set up on the stage. Directly in front of the platform on the floor, are six, long, double-tables cluttered, variously, with papers, chess boards, a few small keyboards and few display screens for those two microcomputers that will be competing for the first time in the nine-year history of the tournament. At both ends of the tables are LA36 DECwriter II terminals, one for each of the two contestants at the table - a total of 14 printers. The two extra ones are for emergency use. The printers have been loaned to the tournament through the kindness of the Digital Equipment Corporation. Each printer now connects to a separate computer through a modem and the computers are scattered throughout the U.S.and Canada.

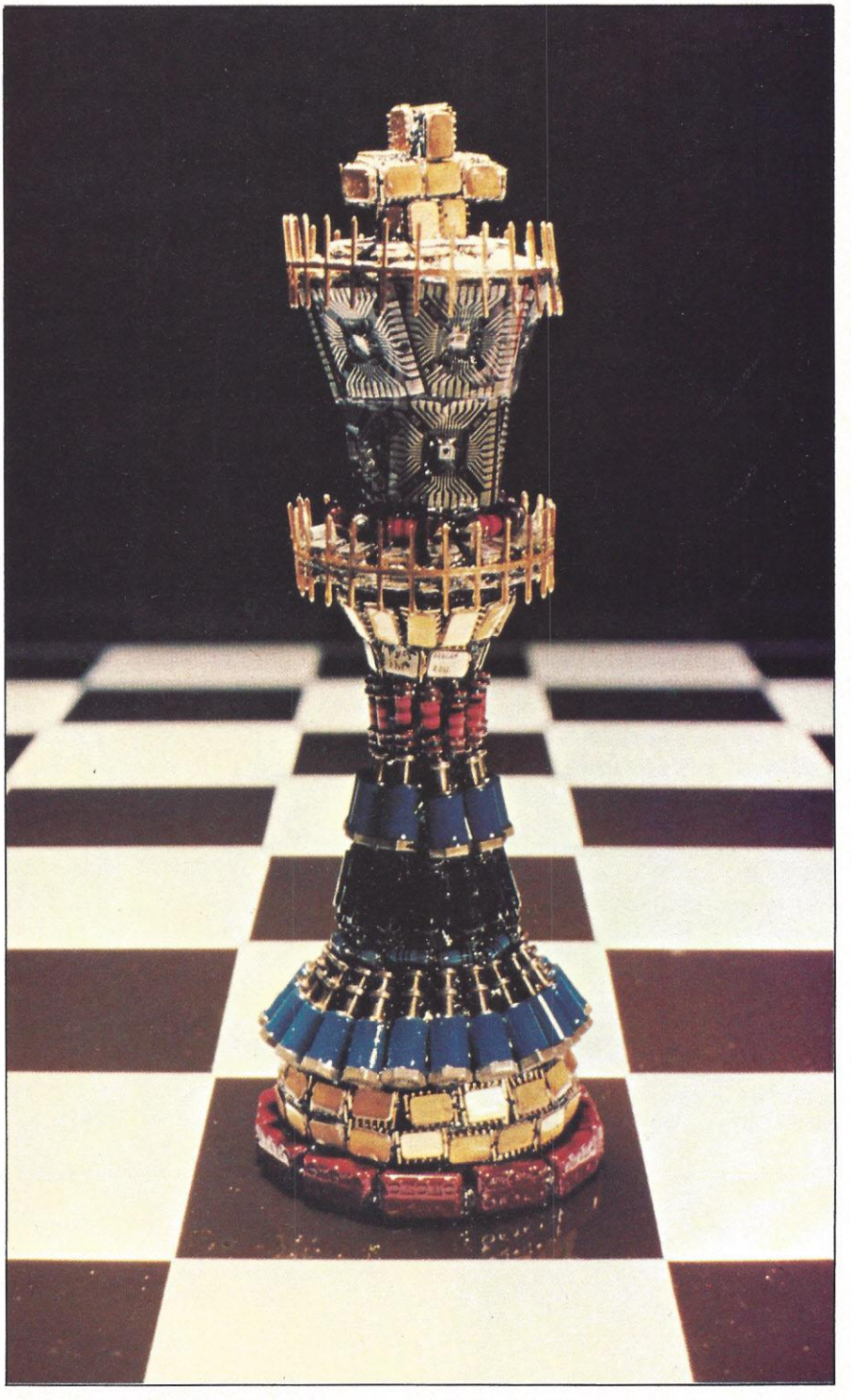
When the contest begins, every move of every game will be entered twice; first into the computer of the white side and then into the computer of the black side. The two microcomputers will not need terminals. The moves are entered directly into the table-top computers and will show up on the monitor display screens. The hungry, giant computers, however, will swallow the arriving moves generated by opponents, digest the information and then consider possible countermoves at an average rate of several hundred thousand considerations per second. In about three minutes the computer will relay its own move through the DECwriter and to the programmer at the table. Developing moves will be followed both at individual table chessboards (every contestant has brought his own favorite good-luck board) and will also be transmitted to the stage where 14 eager attendants will be running around manning the boards and advancing designated pieces to appropriate squares.

Chess analyst, David Levy, will be plodding back and forth on the stage, mike in hand, and will carry on an unceasing commentary over the loudspeaker system telling everyone what is happening in a certain game or what one can expect to happen.

The two opponents at each side of the table will be relaying to each other the chess moves emerging from the deep recesses of their own programs. Each "player" will be occupied reading printouts, tapping out inputs, documenting the game on his own small scorepad, moving chess pieces on the table board, listening to the analysis from the stage and occassionally glancing at some pages in the hard copy programs by his side. The individual players, in fact, will be so busy that they will scarcely pay attention to their opponents.

Sunday, December 3rd, at 12 o'clock, there was a pre-tourney meeting of the participants. Fred Swartz of University of Michigan's CHAOS program stood up and told the small, startled group that he had been robbed in the hotel the night before. Seems that he had arrived late Saturday evening, went down to the chess hall to check out the equipment, came out of the hall at about 11:00 PM and found himself facing the gun of a stick-up man in the deserted hall just outside the chess area. Everyone in the hall spent the next few minutes commisserating with Fred and commenting on the general crime situation that existed in all the big cities of the world. Then, as angry and emotional reactions subsided, the group slowly turned its attention back to chess. There were a few problems that were straightened out - typical of all chess tournaments - including such things as when to declare the draw, clock-time rules, resignations and breakdowns. When all the questions had been answered by the ACM organizing committee (Carl Diesen, Monroe Newborn, Ben Mittman and David Levy,) the meeting adjourned until 1:00 PM and the start of the First Round. This recess gave everyone a brief period in which to gulp down a sandwich for lunch at the upstairs coffee shop.

The computer-chess tournament began witout ceremonies at 1:00 PM when the 12 "players" (See "Table of Participants") sat down at their assigned places. The participating computers and their programs differed physically from each other in almost the same way that 12 marathon runners might differ in dimensions from each other. (see "Technical Details of Participants.") A 50-pound Motorola 6800, for example, found itself in



combat against a giant PDP 11/70 weighing several thousand pounds. But one could not safely state that the smaller contestants would be beaten by the bigger competitors, just as the smallest runner in a race does not always give way to the largest.

Unlike a football game, or a boxing match, there was no starter's signal, no blowing of a whistle, no clanging of a bell to mark the beginning of the event. The tournament started quietly when, at 1:00 PM, Dave Cahlander, of Control Data Corporation and a member of the CHESS 4.7 team, sat down at his DECwriter. He immediately began to tap out a message that was transmitted through a modem up to a huge Cyber 176 at Control Data's computer center, 5,000 miles away in Minneapolis. Dave was clearly the busiest man at the tourney. He sat at the terminal for hours at a time, without a break, and generated "tons" of printouts for the CHESS 4.7 program. The paper rolled out of the DECwriter in large masses and folded itself into a basket container. The printout grew so large that it eventually spilled out of the container and onto the floor. Dave produced as much paper printout as perhaps all other programs combined. One reason, of course, was that everyone present wanted to play against CHESS 4.7; and in the course of the tournament the world-champion program played about ten Blitz games.

The First Round of the tourney began with the six top-seeded contestants playing the botom six. Predictably, the top six emerged victorious in its six initial contests. The most surprising event of the First Round was the tough battle that little MIKE, from England, fought against BELLE, the strongest program in the contest and the one that was to eventually win the tournament championship. The macro-micro struggle lasted for 41 moves before Ken Thompson's program achieved a mate against MIKE. The official documenter and annotater for the tournament, Mike Ciammara, later made several observations about MIKE's line of play: "MIKE's centergame opening is very rarely seen in modern master play. White thus prematurely opened the game enabling Black to equalize quite early." Perhaps with a different opening, the micro program might have made chess history by beating BELLE.

Mike Johnson paused for a minute between moves to talk about himself and his chess program. "I work as a programmer on an IBM for the communications section of the British Post Office," he said. "But I've always been interested in chess. Started playing when I was five. When I read that they were playing pretty good chess on microcomputers in the States, I decided to get involved, too. I bought a Motorola 6800, with 16K RAM and 2K ROM, assembled it myself, wrote my own chess program in Assembly Language on a cassette and used a paper-punch printer for entering the program. When I competed in the first European Microchess tournament in London in the fall of 1978, I tied with BORIS for first place. We then had a play-off for the 250 pound purse and I won. I bought the Motorola simply and only to play chess. And this Washington tournament is the first real chess tournament I've been in. The British Post Office paid for my trip here. They knew I had won the microchess competition in England, and they wanted someone to cover the ACM conference, so they picked me to play in the chess tourney and cover the conference at the same time.

"There's a lot of interest in microcomputers in England. But that interest is being held down because prices are so much higher in England than they are in the States. Everything costs twice as much there. I would like to come to the 10th ACM Chess Tourney if I'm invited. Microcomputers will be offering more competition next time. They're improving quite rapidly."

BRUTE FORCE turned out to be the only program at the tournament that would fail to win a single game during the entire Four Rounds. Its play in the First Round ended abruptly when the program resigned to OSTRICH IV because it could not enter en passant pawn captures. Potentially, though, it is a strong program and when minor inadequacies have been eliminated, it will be a tough competitor.

The Sunday audience was small at this first session. The ACM conference

TABLE OF PARTICIPANTS

PRE-GAME SEEDING	PROGRAM NAME	AUTHORS AND CO-AUTHORS	ADDRESS	CLAIMED CHESS RATING
1.	CHESS 4.7	David Slate Larry Atkin	Northwestern University Vogelback Computer Center Evanston, IL 60201	2030
2.	DUCHESS	Tom Truscott Bruce Wright Eric Jensen	Duke University Computer Science Dept Durham, NC 27706	1860
3.	CHAOS	Mike Alexander Tom McBride Fred Swartz William Toikka Victor Berman Joe Winograd	University of Michigan Computing Center (Fred Swartz) Ann Arbor, MI 48109	1800
4.	BELLE	Ken Thompson Joe Condon	Bell Telephone Labs Room 26523 Murray Hill, NJ 07974	1490
5.	BLITZ 6.7	Robert Hyatt Albert Gower	University of S. Mississippi Box 286, Southern Station Hattiesburg, MS 39401	1700
6.	OSTRICH IV	Monroe Newborn George Arnold Ilan Vardi	McGill University School of Computer Science Montreal, Quebec, H3A 2K6	1520
7.	BLACK KNIGHT	Ken Sogge Fred Prouse Gary Maltzen Lonny Lebahn Elliot Adams	Sperry Univac Co. (Fred Prouse) PO Box 3942 St. Paul, MN 55165	?
8.	AWIT	Tony Marsland	University of Alberta Computing Science Dept. Edmonton, Alberta, T6G 2H1	1500
9.	SARGON II	Kathe Spracklen Dan Spracklen	10832 Macouba Place San Diego, CA 92124	1500
10.	MIKE	Mike Johnson	British PO Telecommunications 207 Old Street London, England EC1	1500
11.	BS '66 '76	Barend Swets	Chopinstraat 65 Venray, Netherlands	?
12.	BRUTE FORCE	Louis Kessler	University of Manitoba 375 Perth Avenue Winnipeg, Manitoba R2V OT8	?

itself wasn't scheduled to begin until Monday and most ACM members hadn't arrived yet. So the Sunday afternoon audience was made up mostly of a few Washington D.C. residents who had come to observe this exhibition because it had been opened free, a nice public relations gesture on the part of ACM.

From time to time during the play, all the computers went into a period of silent meditation at the same point. Not an unusual occurrence in chess, where more time is spent in thinking than in acting. David Levy, who had already begun his three-day journey of strutting back and forth on the stage, now paused before the inactive display boards and looked impatiently down at the participants. For a minute, there, he looked like a dour minister who has just noticed that his congregation has fallen asleep during silent prayer.

If there was a battle going on in the hall one would not know it. Computer chess is a rather polite activity. The hostile computers might be growling at each other, but the programmers themselves are a very friendly sort. Everyone has a close personal relationship with everyone else and there are no smiles of joy when an opponent gets into trouble. It is like two white-gloved gentlemen duelling each other but trying not to inflict any injury. The cameraderie is so strong that one overhears players suggesting lines of play to each other. But will the computer respond? Quite often it doesn't.

Cameras and strobe lights came out of their cases and everyone started taking pictures of everyone else - an activity that was to continue unabated throughout all of the Four Rounds.

Dr. Christopher Evans, of the Penthouse-owned magazine "Omni", was moving about the hall talking to many of the participants and discussing the ambitious, future plans of OMNI. Already, he said, the magazine has added $4000 to David Levy's next bet that he would not be beaten by a computer. Levy says *his* bet of $1000 will only run for five years. Dr. Evans, however, said OMNI has no such time limit. "OMNI is a magazine of the future," he proclaims. "It's about science fact and science fiction and it wants to look at areas that are going to be exciting in the future and we are going to bring them to the people. Apart from our computer-chess interest, we intend to sponsor free public lectures by outstanding scientists. We are going to pay them a good fee and have them come and say something original on computer chess or on any subject they choose, to an audience. We would probably transcribe the lectures and publish them in the magazine."

Round One of the tournament ended around 6 o'clock Sunday evening and as the individual games came to a close, one by one, the audience and the participants slowly dissappeared. There was only a short time, now, to freshen up, have a dinner snack and then hurry back to the hall by 7:30 PM for the beginning of the Second Round. Unlike the First Round, when all contestants were ready and seated by their telephones by 1 o'clock, the evening match began haphazardly. Contestants, knowing now who their opponents were, drifted slowly into the hall. Everyone went to his pre-assigned table and when both opponents had arrived, the DECwriters picked up the chatter where they had left off, as though this Second Round was a continuation of the First Round.

Ben Mittman, handling the pairings, had already posted the results of the First Round plus the match-ups for the new round. It required a little manipulation and some intensive look-ahead on Mittman's part to make sure that programs that had played White the First Round would be playing Black the Second Round, then White on the Third Round and finally, Black again on the Fourth Round. With winners matched against winners, Ben Mittman managed nicely and all the contestants except two (BELLE and BRUTE FORCE) played half their games as White and half as Black.

During the playing of the Second Round, more pictures were taken by roaming spectators and practically everyone signed a birthday card being passed around for Dr. Edward Lasker. Lasker, an International Chess Master, was celebrating his 93rd birthday anniversary and was scheduled to come to the chess tournament on Monday night. Plans were to present him with the birthday card then.

The Second Round crept along at a slow rate and culminated in the longest game of the tournament. Bob Hyatt's Blitz 6.7 became locked in a "death struggle" with Tom Truscott's DUCHESS in a contest that dragged on until 5 o'clock the next morning. When it ended in a mutual agreement for a draw, the hall was completely empty, except for a few security guards. It was reported that both Tom and Bob dozed off from time to time and had to wake each other up when the computer relayed a move. And as the Monday morning sun began to rise over the Nation's Capitol, two, tired participants staggered off to bed for a few hours of sleep.

Monday was the official opening of the ACM conference. The once-quiet halls and lecture rooms and lobbies of the Sheraton Park now became crowded with incoming ACM delegates from all over the world. The weather in Washington on Monday was a delightful, surprising 70-degree day. It was almost like a summer's day. Many conference visitors took advantage of the sunshine and went outdoors for

SOME TECHNICAL DETAILS OF PARTICIPANTS

PROGRAM	LANGUAGE	MEMORY SIZE	COMPUTER	LOCATION OF COMPUTER	OPENING BOOK
CHESS 4.7	COMPASS	7.5K Words (60 bit)	Cyber 176	Minneapolis, MN	5,000
DUCHESS	Assembly	1000K	IBM 370/165	Research Park, NC	3,000
CHAOS	FORTRAN	3 Megabytes	Amdahl 470/V6	Sunnyvale, CA	7,500
BELLE	C	16K Words (16 bits)	PDP 11/70	Murray Hill, NJ	160,000
BLITZ 6.7	FORTRAN	20K Words (32 bits)	Univac 1100/42	Washington, DC	5,000
OSTRICH IV	Assembly	20K Words (16 bit)	Super Nova	Montreal, Quebec	0
BLACK KNIGHT	FORTRAN	35K Words (16 bit)	Univac 1100	Minneapolis, MN	96,000
AWIT	ALGOL-W	350K	Amdahl 470/V6	Edmonton, Alberta	9,000
SARGON II	Assembly	12½K	Jupiter III	On site	0
MIKE	Assembly	16K	Motorola 6800	On Site	0
BS '66 '76	FORTRAN	200K	IBM 370/168	Toronto, Ontario	1,000
BRUTE FORCE	FORTRAN	25K	IBM 370/168	Winnpeg, Manitoba	0

a brief trip around the city. For most of them, it would be the only time they would leave the hotel. The next day it rained and the temperature had dropped to the low 40's and it was winter again. Practically everyone stayed indoors on Tuesday.

In the evening, an hour before the beginning of Monday's Round Three, a panel discussion was held, with Ben Mittman acting as panel moderator. Ben publicly thanked Carl Diesen and explained the many difficulties that Carl had to overcome to arrange for the tournament which was unfolding without any problems.

"When the tournament began yesterday," said Ben to the more than 200 spectators who had gathered to listen, "I predicted this would be a very exciting event with much stronger programs than we've ever had before and the tournament, I said, would prove to be a horse race. When you look at the final results you'll find out what I was talking about.

"A number of things have happened since the 8th ACM championship at Seattle. The growth of microcomputers in chess has been very important. Another activity during the past year was the end of David Levy's 10-year-old bet. He beat CHESS 4.6 at Toronto and won a cool 2500 bucks from a few of our colleagues."

(David later revealed, to some spectators, that his net profit was far less than the publicized amount because certain Toronto people - who were left nameless in the discussion -, managed to skim off some " unanticipated expenses" from the top and decrease the size of Levy's earnings considerably.)

"Not only that," continued Ben in his opening speech, "but more and more publicity has been coming out of the computer-chess world. And all the increased information will, I hope, lead to improvement in the play. In addition to that, in Toronto last August, we started the ICCA and that has been steadily growing with a couple of newletters already published. Monty Newborn, I must tell you, is the originator of this series of chess tournaments. He organized the first tournament back in 1970 in New York. Next year will be the tenth anniversary of these tournaments. I've been honored to work with Monty for eight of those nine years. And I can say, from personal observation that we've come a long way since 1970 and we're heading for bigger and better things in the years to come."

Doctor Lasker had already arrived in the hall by then and David Levy, standing on the stage, announced his presence when Ben had finished talking. Then, David jumped off the stage and handed Dr. Lasker the birthday card with the hundred or so signatures and everyone applauded David's announcement that this was Dr. Lasker's 93rd birthday observance.

After that, and before the Third Round started, David announced that some Blitz chess would be played. Everyone wanted to play against CHESS 4.7, of course, but because of time restrictions, a decision was made

Final Statistics of 9th ACM Computer Chess Tourney

FINAL STANDINGS	PROGRAM	SEED NO. AND PLAYER NO.	COLOR	OPPONENT	MOVES	CUMULATIVE SCORE	COLOR	OPPONENT	MOVES	CUMULATIVE SCORE	COLOR	OPPONENT	MOVES	CUMULATIVE SCORE	COLOR	OPPONENT	MOVES	FINAL SCORE
1	BELLE	4	B	10	41	1	W	1	48	2	B	3	55	3	B	5	14	4
2	CHESS 4.7	1	W	7	41	1	B	4	48	1	W	2	58	2	B	6	36	3
3(tie)	CHAOS	3	W	9	28	1	B	6	39	2	W	4	55	2	B	2	57	2½
3(tie)	BLITZ 6.7	5	W	11	37	1	B	2	94	1½	B	8	63	2½	W	4	14	2½
3(tie)	SARGON II	9	B	3	28	0	W	12	23	1	B	10	50	1½	W	8	29	2½
6(tie)	DUCHESS	2	B	8	48	1	W	5	94	1½	B	1	58	1½	W	3	57	2
6(tie)	OSTRICH	6	B	12	15	1	W	3	39	1	B	7	76	2	W	1	36	2[
8(tie)	BLACK KNIGHT	7	B	10	41	0	W	10	54	½	W	6	76	½	B	12	50	1½
8(tie)	MIKE	10	W	4	41	0	B	7	54	½	W	9	50	1	B	11	15	1½
8(tie)	BS '66 '76	11	B	5	37	0	W	8	32	0	B	12	26	1	W	10	15	1½
11	AWIT	8	W	2	48	0	B	11	32	1	W	5	63	1	B	9	29	1
12	BRUTE FORCE	12	W	6	15	0	B	9	23	0	W	11	26	0	W	7	50	0
			ROUND 1				ROUND 2				ROUND 3				ROUND 4			

Notes on Statistics.

In first round, BRUTE FORCE resigns after 15 moves because it can't enter en passant captures.

In first round, MIKE plays an amazing game of 41 moves against the eventual champion, BELLE

In the second round, CHESS 4.7 loses its only game of the tournament to BELLE, which goes on to win the title.

The 2nd round game between BLITZ 6.7 and DUCHESS turns out to be the longest in the tournament and lasts until 5:00 AM the next morning.

The microcomputers shine in the second round. MIKE draws against the stronger BLACK KNIGHT; and SARGON II beats BRUTE FORCE.

In the third round, BLITZ 6.7 having already played until 5 o'clock in the morning, now plays another long game that lasts until 3:00 A.M. In this game, BLITZ 6.7 announced, at the 62nd move, mate in three, but it finds a mate on the very next move.

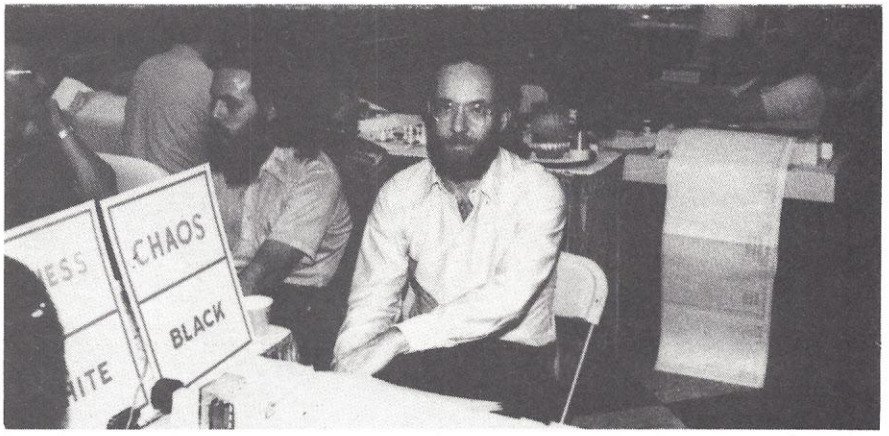
The last-round championship game between BLITZ 6.7 and BELLE turns out to be the shortest game of the tournament when BELLE finds a mate in 14 moves.

to limit the number of Blitz games. One challenger was 4th ranked US Grandmaster Robert Byrne of New York, who played two games and won both. "Not without some difficulty," he confessed. Later, Mark Diesen of Maryland, son of tournament organizer Carl Diesen, played two games Mark is 19th-ranked US grandmaster as well as the youngest grandmaster in the country (he had just turned 21 which admitted him to the senior ranks). He lost both games. "It was Mark's first time to play against the computer," said Carl, "and the fast-moving clock bothered him. He spent too much time worrying about the clock and not concentrating on the game." Dr. Edward Lasker also played against CHESS 4.7 and lost. At 93, Dr. Lasker does not play as well now as he did in 1959 when he appeared at New York Times Life Center in one of the first public matches against an IBM computer-chess program. "That time," he reminisced, "I let the game go 14 moves because I didn't want to kill it too early. It was a public demonstration of the powerful IBM computer. The IBM people told me to take it easy. They wanted their computer to look sharp," he confessed, revealing a trade secret for the first time, "so I let it live for 14 moves."

That early chess program, one of the first ever written for a computer, was prepared by Alec Bernstein of New York's IBM research staff and was run on an IBM 704, the very last model of the old-fashioned electronic-tube computers. Transistors replaced the vacuum tubes thereafter, and the computer industry began to take giant strides in its development.

The Third Round of Monday night found the two microcomputers facing each other. European champ, MIKE, and U.S. title holder, SARGON II, played each other to a draw. During this same round, BLITZ 6.7 became caught in another lengthy game; this time with Tony Marsland's AWIT. "Things were a little better tonight, though," Bob Hyatt later remarked, "because we only played until 3 o'clock in the morning and had only 63 moves and we won. That was better than the 93 moves against Tom Truscott's DUCHESS which ended in a draw." So it turned out to be another sleep-shortened night for Bob who must now hold the record for playing the longest two successive games in a tournament, and for getting less sleep than any other participant. Most of the action on Monday night was pro-

Ken Thompson (BELLE) accepts first prize for winning the tournament. Watching are (l. to r.) Robert Byrne, Dr. Lasker and Carl Diesen.



Fred Swartz (CHAOS) suffered the nerve-shattering experience of being the first participant to be robbed during a tournament.

Kathe and Dan Spracklen emerged with the best microcomputer chess program (SARGON II) and finished in a historic third-place tie.

Dave Cahlander chats with Dr. Lasker, an honored guest at the tourney, who was celebrating his 93rd birthday anniversary.

At 5 o'clock in the morning, Tom Truscott sits at DUCHESS' terminal, waiting for the 94th move against BLITZ 6.5

Monty Newborn (of the OSTRICH IV program) originated the computer-chess tournaments for ACM, nine years ago.

vided by David Levy, who, someone suggested, wore out a pair of shoes in his constant paradings on the stage. He stopped at every board to comment on the activity, to predict the outcome and to point out possible variations. At one point, at the CHESS 4.7 vs DUCHESS board, he noticed a development as he moved the pieces about. "If Black goes here," he said over the mike, "then White goes here, here, here and here to reach a winning position. However," he said after a moment's reflection, "if White goes there, then Black goes here, then here then here to reach a formidable formation of its own." He replaced the pieces to their original positions then, after a moment's reflection, he observed, "As a matter of fact - at this point, – both sides are winning!"

A few times, David became embroiled in a friendly argument with some of the spectators. "If the Rook goes here then the Bishop comes out to here and traps the Knight." "But yah," sputtered an excited chess addict from the audience, "then the other Knight moves to King Bishop Five to fork both the Rook and Bishop to win back a piece."

David studied the board for a minute. "But if he does that," he finally retorted, "then White moves his Queen here to pretty well destroy the defense," "But yah," said the spectator, "if the Queen moves out, then Black brings his Rook down the center and he's got a possible mate in three!"

Levy studied the board for a few minutes. "Indeed?" he said. Realizing that chess arguments, like political arguments, are not easily won, he returned the pieces to their original game position and observed politely: "Quite possible! Quite possible, indeed!" Then he moved quickly to the next board to play a small game of variations there.

At the end of the Third Round, the two leaders in the tournament were BLITZ 6.7 and BELLE and it was announced that these two would be meeting each other for the championship on the Fourth and Final Round, to be held the following night (Tuesday.)

The last picture one got of the computer-chess tourney late Monday night, just before most of the games were finally completed, was that of David Levy. He had deserted the stage and was now sitting beside Monty Newborn at the players table. David had taken off his black coat, pulled open his tie, rolled up his shirt sleeves and

sat in the chair, exhausted, tired and thoroughly enervated. He looked very much like a hiker who has just walked 50 miles with a back pack. The mike was still in David's hand and he still gave word descriptions of the chess activity, but he did it now from his sitting, collapsed position.

Slowly the tournament reached the final day. The Last Round began after Carl Diesen had commandeered all free DECwriters and had obtained printouts of the first Three Rounds. The results had been collected and checked by Mike Ciamarra, of Rockville, MD, a local chess organizer, who had added his own astute annotations to each of the 18 games. Before the evening was over, Carl and his hard-working wife, who was serving as his assistant, had managed to print out enough sheets of the tournament to that point to give everyone a copy. Those that wanted a copy of the Last Round, about to get under way, would be mailed one, announced Carl, if names and addresses were left behind.

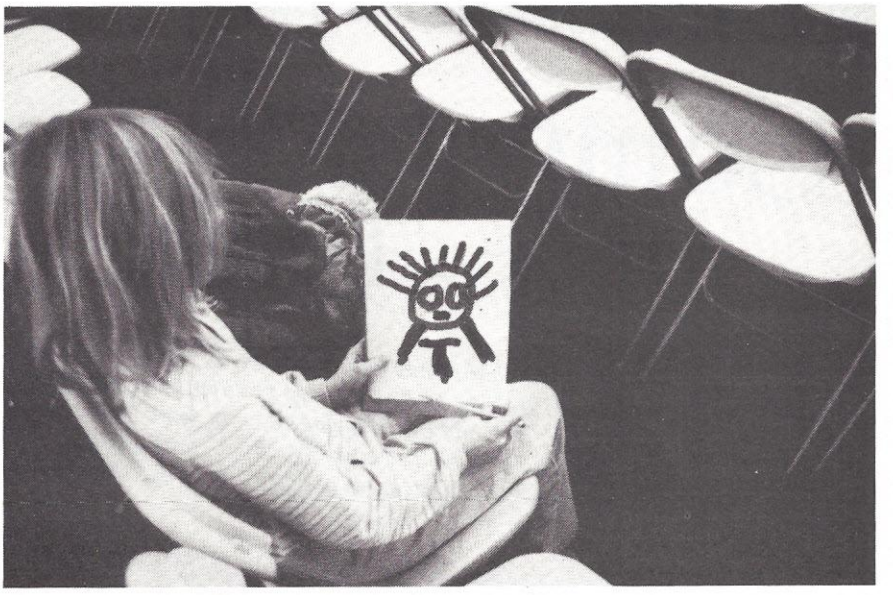
The biggest news item of the Fourth Round, of course, was the victory of BELLE over BLITZ 6.7. The game, to everyone's astonishment, turned out to be the shortest of the entire tournament - only 14 moves.

At the conclusion of the tournament there was a closing ceremony. Silver cups for the first 3 places were presented by Dan McCracken, President of ACM.

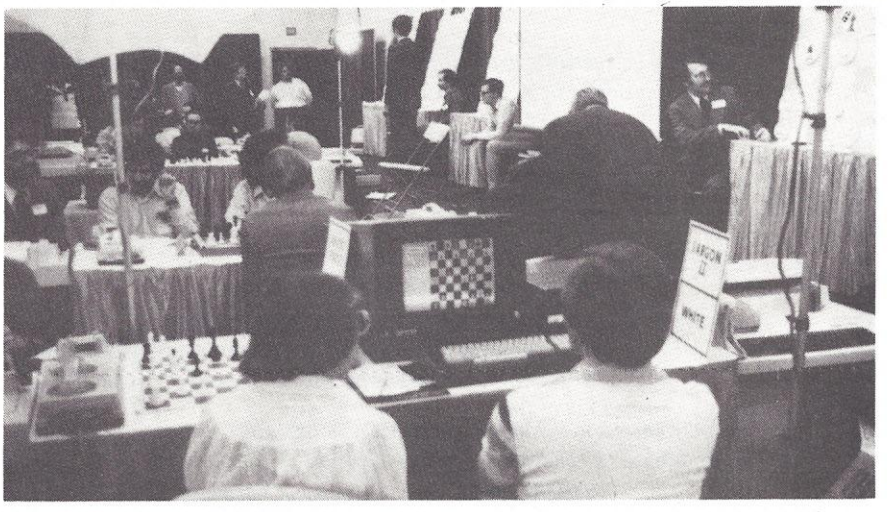
Everyone had a few nice things to say. David Levy summed it all up with his closing comments: "Every year the programs get stronger. And the thing that is most remarkable of all is the performance of the micros. Both SARGON II and MIKE have done very well here. They've proven that you don't have to spend something like five million dollars to play a good game of computer chess. You can now do it with a small machine. I think it's remarkable that the two microcomputer participants have acquitted themselves extremely well. Monty Newborn may well be right, as he suggested earlier, that the time is coming when you'll be able to play computer chess in something as small as a matchbox."

In bringing the 9th Annual Chess Tournament to a formal conclusion, President Dan McCracken said: "I want to welcome everybody to next year's 10th anniversary. I can tell you now that we're going to have a spectacular meeting!"

And everyone clapped and cheered and walked away wondering about next year's tournament.

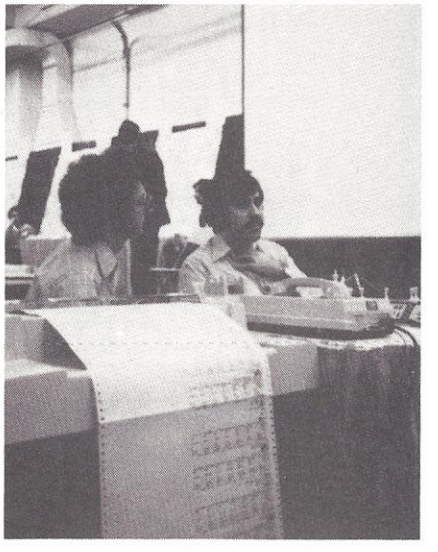


Bored by the chess activity, this young spectator executes a sketch which, she says, is a picture of David Levy.



SARGON II (with the Spracklens watching) shown in the middle of a game against BRUTE FORCE. SARGON II won.

Barend Swets (BS '66'76) vs Bob Hyatt (BLITZ 6.5). BS '66'76 resigned after 37 moves.



Atkins and Slate study the display boards as the DEC printer uncoils a mound of printouts.

Computer Languages Quiz

The first micros understood only assembly language; later machines learned BASIC. Today, you can program your micro in COBOL, FORTRAN, APL and other languages, with more becoming available almost daily. How much do you know about computer languages in general and the various languages in particular? Take this quiz and find out.

BY DONALD D. SPENCER

1. When you identify programming languages suitable for use with scientific applications, the language _____ does not belong in the set described by the other three.
   a. APL
   b. FORTRAN
   c. RPG
   d. PL-1

2. COBOL is
   a. a time-sharing system
   b. a mathematical programming language
   c. a language developed for programming business problems
   d. a computer developed by IBM

3. The method in which the computer is used to translate a program written in a symbolic language into intermediate or machine language is called
   a. compiling
   b. automatic translating
   c. automatic coding
   d. none of the above

4. The development of the first FORTRAN compiler (for the IBM 704 computer) was a
   a. 13 man-year effort
   b. 4 man-year effort
   c. 52 man-year effort
   d. 25 man-year effort

5. A programming language which was developed at Bell Telephone Laboratories especially to facilitate handling strings of symbols on a computer is called
   a. APL
   b. RPG
   c. LISP
   d. SNOBOL

6. A variable name followed by one or more subscripts is called a _____

7. A programming system which translates a high level source language into a language suitable for a particular machine is called
   a. an assembler
   b. a symbolic translator
   c. a compiler
   d. FORTRAN

8. A popular scientific-oriented programming language for computers is called
   a. COBOL
   b. RPG
   c. MAGICTRAN
   d. FORTRAN

9. A translator that converts a source language statement into machine code and immediately executes the converted statement before translating and executing the next statement is called
   a. an assembler
   b. an interpreter
   c. a compiler
   d. a generator

10. Computer languages are often referred to as
   a. natural languages
   b. artificial languages
   c. real-time languages
   d. pseudo languages

11. PL/M is
   a. a type of microcomputer storage
   b. the acronym for microcomputer
   c. a programming language used to program microcomputers
   d. none of the above

12. True or False: A common language is one that can be used on more than one digital computer, often made by different manufacturers.

13. A programming language most often used with microcomputers is
   a. LOGO
   b. BASIC
   c. PASCAL
   d. COBOL

14. Source programs are
   a. programs written in binary
   b. always stored on magnetic tape
   c. prepared by senior programmers
   d. none of the above

15. A macro instruction is
   a. an instruction in a source language that represents several instructions in machine language
   b. usable only on IBM computers
   c. used to control the input and output operations of a computer
   d. used only in programs written for real-time systems

16. A logical notation (developed by Jan Lukasiewicz in 1929) for a series of arithmetic operations in which no grouping symbol is used is called
   a. Boolean algebra
   b. Polish notation
   c. process control
   d. metalanguage

17. True or False: A compiler is a computer program that converts programs written in a symbolic language to machine language instructions for the computer to execute.

18. A computer program written using machine operation codes and addresses is written in
    a. high-level language
    b. symbolic language
    c. procedure-oriented language
    d. machine language

19. What belongs in the center box?
    a. compiler
    b. assembler
    c. generator
    d. executive

20. A problem-oriented programming language used for solving geometric and civil engineering problems is
    a. PASCAL
    b. COGO
    c. SAP
    d. MICRO

21. FORTRAN is to scientific applications as _____ is to business applications.

22. Statements printed by a compiler indicating errors detected in a source program are called
    a. machine language statements
    b. diagnostics
    c. errors
    d. program listings

23. True or False: "Compile-and Go" refers to an automatic coding procedure which compiles the source language program and immediately executes the generated machine language program.

24. True or False: Backus Naur Form (BNF) is a notation invented by John Backus and Peter Naur for describing the syntax of programming languages.

25. A machine independent program
    a. is one which can be executed with or without a computer
    b. is developed in terms of the problem rather than in terms of the characteristics of the computer system
    c. can never be executed on a machine such as a computer
    d. must be translated into a specific machine language by an interpreter

26. A language specifically designed for programming simulation problems is called
    a. APT
    b. SIMSCRIPT
    c. BASIC
    d. LOGO

27. The rules governing statement, sequence or sentence structure in a programming language is called
    a. macro definition
    b. syntax
    c. metalanguage
    d. none of the above

28. An interpreter is a
    a. program that decodes and immediately executes instructions written as pseudo instructions
    b. computer program which enables a computer to operate upon a program written in some pseudo language other than machine language
    c. a translator used to transform and execute source language programs
    d. all of the above

29. A program written in PASCAL is called
   a. a machine language program
   b. a source language program
   c. a target language program
   d. an assembly language program

30. A compiler
   a. translates source language programs into object programs
   b. translates object language programs into machine language programs
   c. converts assembly language usable programs
   d. is a hardware device

31. The following program produces the first N terms of a Fibonacci series. What language was used to write this program?
   a. PASCAL
   b. FORTRAN
   c. RPG
   d. APL

```
     ∇ R←N FIB A
[1]    R←A
[2]    →(N=2)/0
[3]    R←(N-1) FIB A
[4]    R←R, (R+¯1ΦR)[ρR]
     ∇
```

32. The following program computes the sum of the first ten odd integers. The program was written in which of the following languages?
   a. BASIC
   b. COBOL
   c. ALTAIR
   d. LOGO

```
10 REM SUM OF THE FIRST TEN ODD
11 REM INTEGERS
20 LET N = 1
30 LET S = 0
40 LET C = 1
50 LET S = S + N
60 LET N = N + 2
70 LET C = C + 1
80 IF C <= 10 THEN 50
90 PRINT "SUM OF INTEGERS ="; S
99 END
```

33. The following program calculates the sum of the squares of the first 100 positive integers. The program was written in
   a. BASIC
   b. LOGO
   c. FORTRAN
   d. APL

```
      J = 0
      NSUM = 0
50 J = J + 1
      NSUM = NSUM + J**2
      IF (J-100) 50,60,60
60 WRITE (6,75) NSUM
75 FORMAT (I8)
      STOP
      END
```

34. The following program uses the formula A=½bh to compute the area of a triangle. The program was written in which of the following languages?
   a. PL/I
   b. FORTRAN
   c. COBOL
   d. MICROTRAN

```
TRI: PROCEDURE OPTIONS (MAIN);
DECLARE (BASE,HEIGHT,AREA) FLOAT;
START: GET LIST (BASE,HEIGHT);
IF BASE=0 THEN STOP;
ELSE DO;
AREA=1/2*BASE*HEIGHT;
PUT SKIP LIST (BASE,HEIGHT,AREA);
GO TO START;
END;
END TRI;
```

35. Which one of the following languages is used to write instructional programs for computer assisted instruction (CAI) systems?
   a. COURSEWRITER
   b. PROGRAMWRITER
   c. FORTRAN
   d. CAIWRITER

Answers on p. 107

THE MICRO-GRAPHICS X-Y PLOTTER

by Kathe Spracklen

Part Two

With the ground work of micrographics explained in the first of this two part series, the author now discusses the theory behind the X-Y graphics plotter.

The plotter is a subroutine which takes, as inputs, the X and Y coordinates of any dot on any specified size graphics matrix and can, on demand, lighten, darken, complement or inspect that particular dot. Every feature and technique in the process is shown in the following explanation. Numerous diagrams and examples have been included to illustrate the text. The conclusion of this article is a documented TDL Z-80 assembler code version of the plotter subroutine. Also included are a macro flow chart plus individual instruction level flow charts for each section of the code. A short list of equates for machine dependencies in the code, plus documentation of the variable aspects, are included to enable the subroutine to serve the widest possible range of users.

Having previously explained the mechanism of graphics control, and the charting of graphics characters, the X-Y plotter is now ready for use in conjunction with your microcomputer. The plotter can be used in any of the following possibilities:

- As a library routine in conjunction with other Assembly Language programs.
- As a user-provided routine in conjunction with a game or charting program in BASIC.
- As an introduction to graphics control programming in general.
- As an introduction to Assembly Language programming for BASIC programmers.
- As a study case for program optimization, because frequent opportunities to "customize" the program become available.

General design outline of the plotter routine:

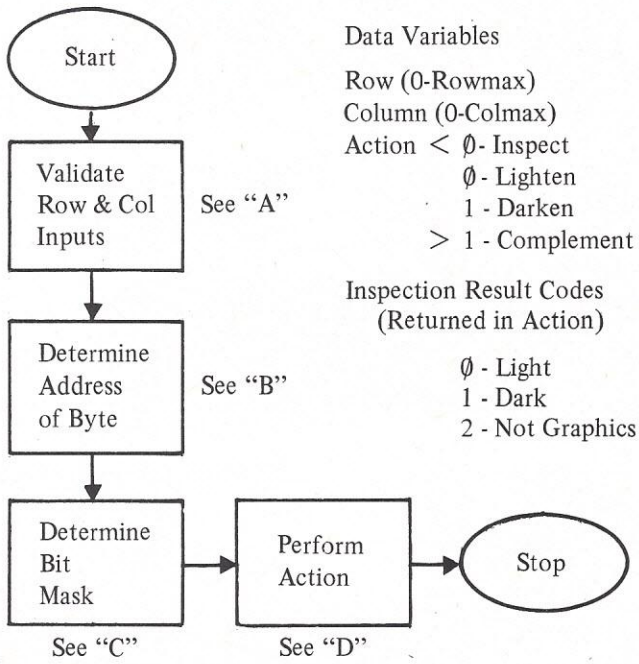
```
X-Y Graphics Plotter
Data Variables
    Row (Ø–Rowmax)
    Col (Ø–Colmax)
    Action
      <Ø–Inspect
       Ø-Lighten
       1–Darken
      >1–Complement

Result Codes
    (Returned in Action)
    Ø–Light
    1–Dark
    2–Not Graphics
```

```
Table of Equates
(Using 12 x 12 example)
Rowmax = 11
Colmax = 11
Mltplr =   6          ; Row Multiplier
Base =     Ø          ; Video Base Address
```

```
Data Variables
Row:        .BLKB     Ø1
Column:     .BLKB     Ø1
Action:     .BLKB     Ø1
```

X-Y GRAPHICS PLOTTER – "FLOW CHART"

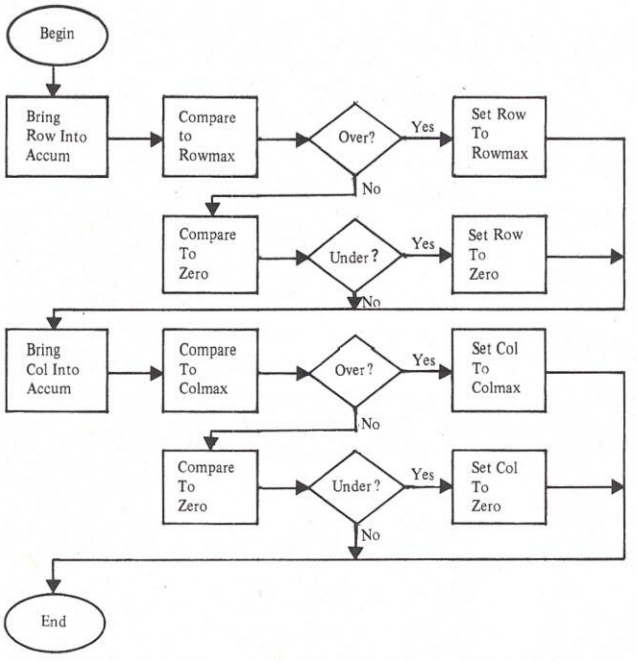
With the design outline complete, the next step is to produce a Macro Flow Chart, so called because only major functions are shown, not individual instruction steps.



Now each block in the Macro Flow Chart can be expanded into an instruction level flow chart and then into Assembly

Language code. (TDL Z-80 Assembly Language will be used for the code, but the flow chart should be translatable into any Assembly Language.)

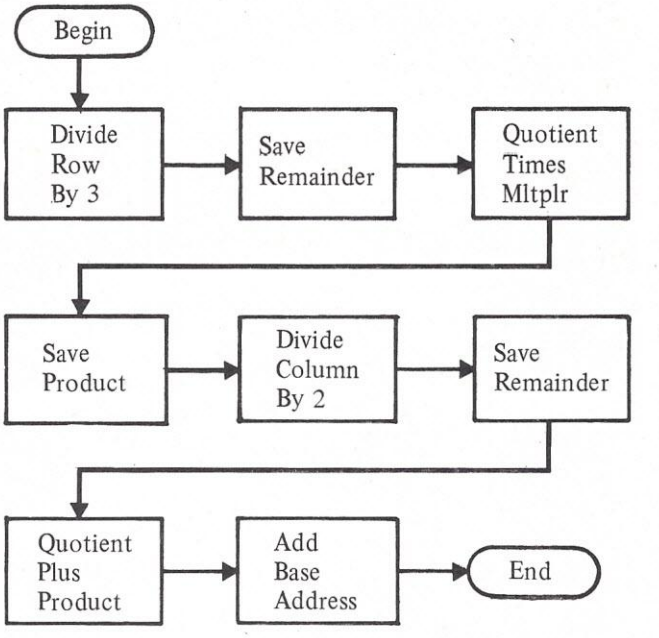
A. Validate Row and Column Inputs




```
VALID:  LDA     ROW         ; Bring Row into
                              Accumulator
        CPI     ROWMAX+1    ; Compare to Rowmax
                              (+1 for test)
        JRC     VALØ5       ; Branch if not over
                              Rowmax
        MVI     A,ROWMAX    ; (A ← Rowmax)
        STA     ROW         ; Set Row to Rowmax
        JMPR    VAL1Ø       ; (Skip less than zero
                              test)
VALØ5:  CPI     Ø           ; Compare to zero
        JP      VAL1Ø       ; Branch if not under
                              zero
        SUB     A           ; (A← Ø)
        STA     ROW         ; Set row to zero
;
VAL1Ø:  LDA     COLUMN      ; Bring column into
                              accumulator
        CPI     COLMAX+1    ; Compare to Colmax
                              (+1 for test)
        JRNC    VAL15       ; Branch if not over
                              Colmax
        MVI     A,COLMAX    ; (A ← Colmax)
        STA     COLUMN      ; Set column to colmax
        JMPR    VAL2Ø       ; (Skip less than zero
                              test)
VAL15:  CPI     Ø           ; Compare to zero
        JP      VAL2Ø       ; Branch if not under
                              zero
        SUB     A           ; (A ← Ø)
        STA     COLUMN      ; Set column to zero
;
VAL2Ø:  . . .               ; No doubt Val 2Ø's
                              name will change
                            ; To that of the next
                              routine
```

Comments: Economies are possible here. If the program loads row, validates it, and goes on at once to compute the row displacement, then it would not be necessary to store the corrected value back in row. The same thing holds for column. Also in the case of a 96 X 128 matrix, a common size, the colmax is the maximum possible one-byte value, so the "CPI Colmax + 1" should be eliminated, as it is totally unnecessary. For a 128 X 128 matrix, no maximum tests need be made at all.

B. Determine Address of Byte



But again this is really a Macro Flow Chart since micro computers do not possess multiply and divide instructions. Division by 2 can be accomplished by shifting the register to the right one bit. If the row multiplier for a specific matrix size turns out to be a power of two, as it often will, shifting can substitute for multiplication. But there's no way out of dividing by 3.

The Macros used for multiplication and division are a simplification of the booth algorithm and they only work for positive integers.

```
ADDR:   LXI     H,Row       ; HL ← Address of row
        MOV     E,M         ; Into reg. D for division
        SUB     A           ; Clear reg. A for division
        MVI     D,3         ; Set up divisor
        DIVIDE              ; Macro call
        MOV     M,A         ; Save remainder in row
        MVI     D,MLTPLR    ; Row multiplier
        MULT                ; Macro call/(AE) ← Row
                              displ.
        MOV     D,A         ; (DE) ← Row displace-
                              ment
        INX     H           ; HL ← Address of
                              column
        MVI     B,Ø         ; Clear reg. B
        MOV     A,M         ; Into reg. A for shift
        SRAR    A           ; Division shift style
        RALR    B           ; Remainder into B
        MOV     M,B         ; Save remainder in
                              column
```

```
LXI     H,BASE      HL ← Video base
DAD     D           ; Base + row displ.
MOV     E,A         ; E ← Column displ.
MVI     D,Ø         ; D ← Ø
DAD     D           ; Base + Row + Column
                      displ.
PUSH    H           ; Saving Byte address
```

Comments: Now it can be seen how intermeshing this routine with the previous one could save instruction time, since row and column values would not have to be fetched from memory. By similar methods, the remainders would not have to be stored and then later retrieved.

But coding it this way, instead of a jumble of intertwined procedures, should hopefully lead to maximum clarity.

DIVISION MACRO

Parameters

IN = A - High order Byte of dividend
E - Low order Byte of dividend
D - Divisor

OUT = A - Remainder
E - Quotient
D - Still contains divisor

```
        .DEFINE DIVIDE [%DIVØ5, %DIV1Ø,
        %DIV15] =
        [PUSH   B       ;;Save Register
        MVI     B, 8    ;;Loop Counter
%DIVØ5: SLAR    E       ;;First part of AD pair
                          shift
        RAL             ;;Complete shift
        SUB     D       ;;Subtract divisor
        JM      %DIV1Ø  ;;Branch if negative
        INR     E       ;;If positive, increase
                          quotient
        JMPR    %DIV15  ;;And skip next instruc-
                          tion
%DIV1Ø: ADD     D       ;;Add back divisor
%DIV15: DJNZ    %DIVØ5  ;;Loop a total of 8 times
        POP     B]      ;;Restore register
```

MULTIPLICATION MACRO

Parameters

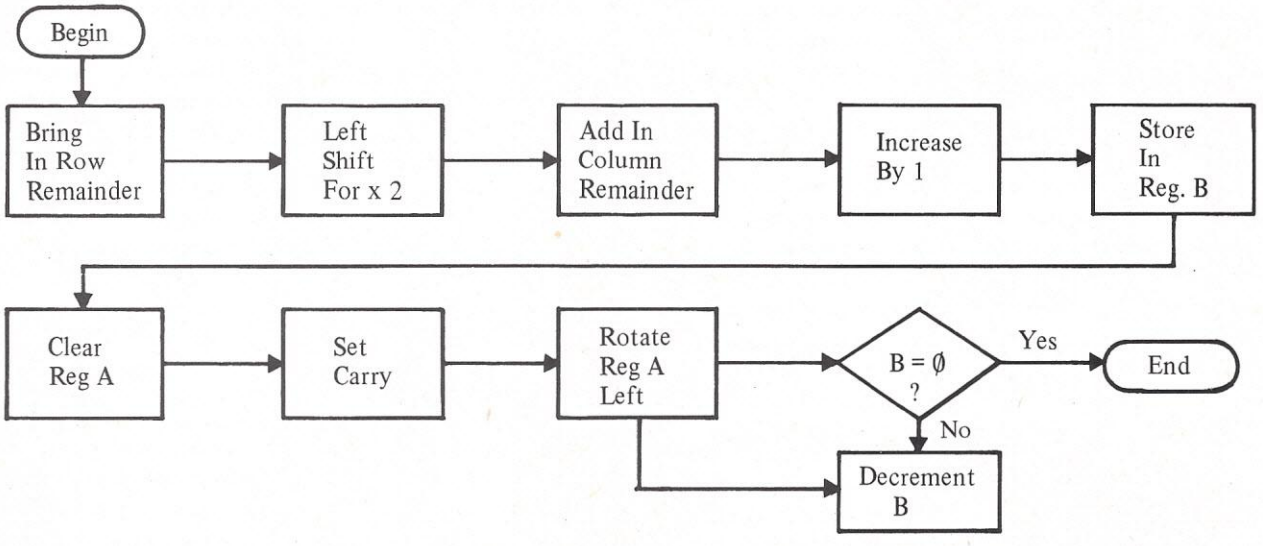
IN = E - Multiplicand
D - Multiplier

OUT = A - High order Byte of product
E - Low order Byte of product
D - Still contains multiplier

```
        .DEFINE MULT[%MLØ5, %ML1Ø] =
        [PUSH   B       ; ;Save register
        SUB     A       ; ;Clear reg. A
        MVI     B, 8    ; ;Loop counter
%MLØ5:  BIT     Ø, E    ; ;Check rightmost bit
        JRZ     %ML1Ø   ; ;Branch if zero
        ADD     D       ; ;Else add in multipli-
                          cand
%ML1Ø   SRAR    A       ; ;First part of AD pair
                          shift
        RARR    E       ; ;Complete shift
        DJNZ    %MLØ5   ; ;Loop a total of 8 times
        POP     B]      ; ;Restore register
```

Note: For an explanation of how these macros work see *Assembler Language Programming* by George W. Struble, Addison Wesley Publishing Co. 2nd Ed. pgs. 71 & 75.

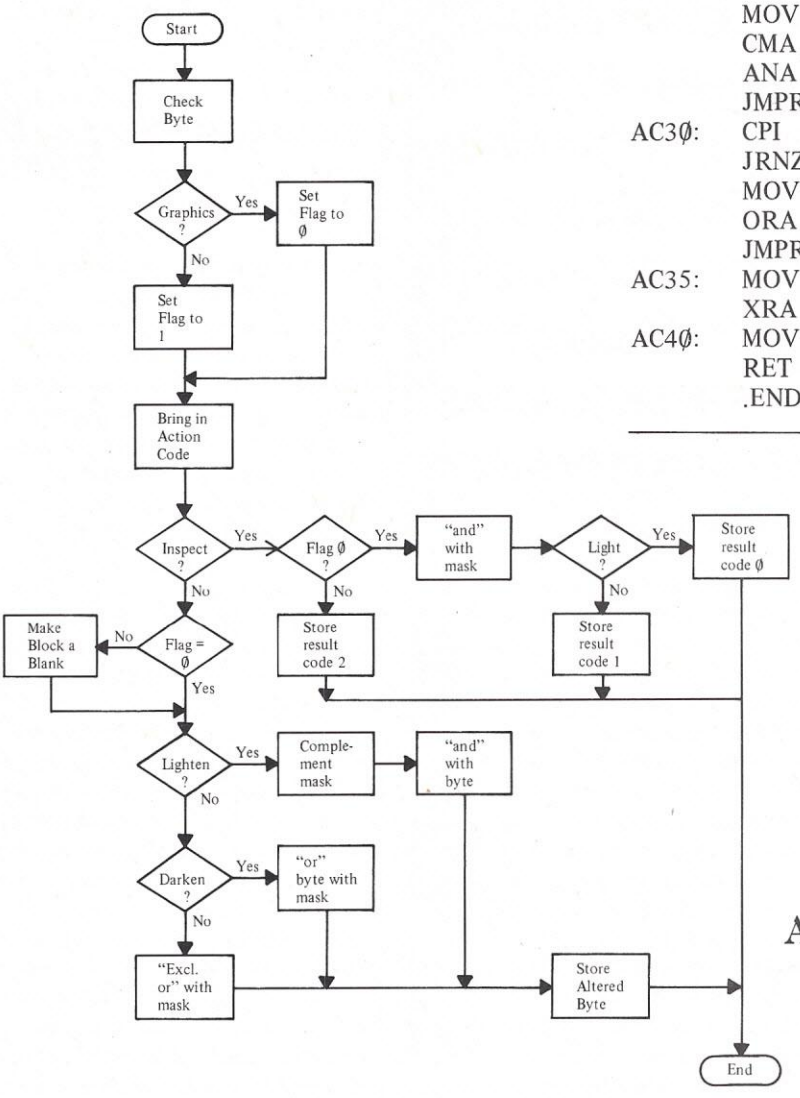
C. Determine Bit Mask



```
MASK:   LXI   H,Row ; HL      Address of row
        MOV   A,M   ; Bring in row remainder
        RLC         ; Left shift for times 2
        INX   H     ; HL      Address of column
        ADD   M     ; Add in column remainder
        INR   A     ; Increase by 1
        MOV   B,A   ; Store in reg. B
        SUB   A     ; Clear reg. A
        STC         ; Set carry
MSK5:   RAL         ; Rotate reg. A left
        DJNZ  MSK5  ; Repeat until B = Ø
        MOV   B,A   ; Mask is in reg. B now
```

D. Perform Action

```
ACTN:   POP   H       ; Restoring byte address
        BIT   7, M    ; Is it graphics?
        EXAF          ; Store flag result
        LDA   ACTION  ; Bring in Action code
        CPI   Ø       ; To test for less than Ø
        JP    AC2Ø    ; No-not inspect-branch
        EXAF          ; Restore flag result
        JRNZ  ACØ5    ; If graphics, branch
        MVI   A, 2    ; Else result code s/b 2
        JMPR  AC15    ; Branch to store code
AG05:   MOV   A, B    ; Bring in mask
        ANA   M       ; "and" with mask
        JRZ   AC1Ø    ; If light-branch
        MVI   A, 1    ; Else result code s/b 1
        JMPR  AC15    ; Branch to store code
AC1Ø;   SUB   A       ; Result code s/b Ø
AC15:   STA   ACTION  ; Store code
        RET           ; And return
;
AC2Ø:   EXAF          ; Restore flag result
        JRNZ  AC25    ; If graphics-branch
        MVI   M, 80H  ; Else make block graphics
                      blank
AC25:   EXAF          ; Restoring result of action
                      test
        JRNZ  AC3Ø    ; If ≠Ø branch/Else lighten
        MOV   A,B     ; Bring in mask
        CMA           ; Logically complement mask
        ANA   M       ; "and" complement with byte
        JMPR  AC4Ø    ; Branch to store byte
AC3Ø:   CPI   1       ; Is it a darken?
        JRNZ  AC35    ; No-branch
        MOV   A, B    ; Bring in mask
        ORA   M       ; "or" mask with byte
        JMPR  AC4Ø    ; Branch to store byte
AC35:   MOV   A, B    ; Bring in mask
        XRA   M       ; Complement/"exclusive or"
AC4Ø:   MOV   M, A    ; Store altered byte
        RET           ; And return
        .END
```



Note:
For an explanation of how the macros work see Assembler Language Programming by George W. Struble, Addison-Wesley Publishing Co. 2nd Ed. pgs. 71 & 75.

CONNECTING THE DISK PART I: How Disks Work

BY RODNAY ZAKS, SYBEX, Inc.

This preliminary article discusses how disks work and, further, what disks are all about.

Three main types of disks can be connected today to a microcomputer system. Different disks exist, but are not applicable to microcomputers. These three types are hard disk, floppy disk, and mini-floppy.

All three involve similar principles of operation, (which will be described in Part II.) The essential physical difference is that a hard disk, as its name indicates, is hard. The floppy, or its smaller sister the mini-floppy, are soft disks. The floppy is characterized by a low cost. However, it also has reduced capacity and longer access time than the hard disk.

There is no standard for hard disks, and a large variety of models exists today. These disks are typically characterized by a million bytes storage or more on a single unit. However, hard-disk cost is high. The floppy disk, originally invented by Shugart, but now manufactured by a variety of other companies, uses an 8" soft diskette. The diskette rotates inside a cardboard holder. In order to reduce friction the inside of the cardboard is lined with a special low friction plastic lining. To access data on this diskette, a long hole is made in the cardboard jacket through which a read/write head is applied against the surface. Data on the diskette is organized, in sectors and tracks, just as it is on the hard disk.

The mini-floppy, a 5.25 inch diskette, is a scaled down version of the regular floppy. It stores less data, but is available at a low cost. The mini has become the most popular mass storage medium for personal microcomputers today.

Principles of operation

Every disk, whether hard or soft, is coated with magnetic oxide on one or both sides. There is no significant problem in coating a diskette on both sides; however, most disk-drives are single sided. This single-drive system is popular because the mechanical cost of arranging two opposing heads to access the same diskette is quite high. For this reason, dual drives are usually preferred, where two independent diskettes are provided but a single positioning mechanism to access the diskettes is used for both heads.

For most hobby–type applications, the mini–floppy disk is ideal. It offers a mass memory sufficient for all typical files used in a home environment.

Data on the disk is organized in sectors and tracks as mentioned above. Tracks are concentric rings on the surface of the disk. One of the basic mechanical problems for a designer is to position the read/write head exactly over the area of the disk in which data is to be stored or retrieved and to perform this operation quickly. It is therefore necessary to have highly structured data on the surface of the disk. Because tracks store thousands of bytes of data, a smaller unit of information is required. In a standard memory this unit of information would be a word (here a byte). Unfortunately, in the case of disks, the access time required to position the head before data can be read or written is very significant. It is of the order of 20 milliseconds. Accessing a single word in 20 milliseconds would be completely uneconomical. In practice, therefore, almost all disks are divided into sectors of approximately 128 words. A sector corresponds to a block of data between two successive radials on the disk. The cutting of a disk into sectors is analogous to the way a pie would be sliced.

One obvious fault that arises is that sectors on the inside track of the disk will be physically small compared to sectors on the outside track of the same disk. Therefore, why not pack more data on the outside tracks than on inner ones? The essential parameter in disk control is rotation speed. This rotational speed is the same for any point of disk on the same radial.

Formatting the sector

In addition to formatting a disk into tracks and sectors, more information must be written in every sector. Furthermore, the beginning of every sector must be clearly defined. Two techniques are used for this purpose: soft sectoring and hard sectoring. A hard-sectored disk begins every one of its sectors by an actual hole punched in the disk. The disk drive is equipped with a photoelectric sensor and whenever a hole is detected in the disk, the beginning of a new sector is identified. The method is quite simple. Soft sectoring, on the other hand, uses a single hole to mark the beginning of sector zero and all subsequent sectors are identified through a timing track which is read from the disk. However, for reliability of operation, it is naturally better to be able to verify the actual sector and track number of any block of data before accessing it.

For this reason, a sector is generally preceded by a small block of information containing the track number and sector number. These two parameters are normally verified by the disk controller prior to disk access. In addition, every block of information on the disk, whether identification block or a user – data block, is terminated by two or more CRC characters. CRG stands for "cyclic redundancy check". This is a

useful polynomial method to verify the integrity of data stored in the block. When data is stored in the disk, the CRC is automatically computed for all bytes stored in the block, and the CRC which has been computed is then stored at the end of the block. Whenever this data is read again, the CRC will again be computed, and compared to the stored data at the end of the block. If any discrepency appears, the data is in error. If no discrepency is found, the data is probably correct.

As a final detail, once the disk is used, minor speed variations as well as slight physical changes occur on the surface of the disk. As a result, when various blocks are read or written, one will find that the blocks are not occupying the exact space that should be theirs. It is necessary, therefore, to space adequately all blocks on the surface of the disk. Such formal spaces between blocks are called "gaps." Each gap is usually identified by well defined characters contained in its header.

Representing bits on the disk

Bits are recorded on the disk by magnetizing its surface in one direction or another. The technique involves recording a succession of logical zeroes and logical ones on the surface. Because fluctuations occur in the rotational speed of the disk, all systems use a self clocking technique for the data bits. Each data bit is preceded by a clock pulse. A logical one is produced by a clock pulse followed in the middle of a time interval by another pulse (the one). A zero will be produced by a clock pulse with no pulse in the middle of the time interval. This is called "clock" and "data" information. Both clock and data information will be available at the output of the disk drive.

Special "address marks" are obtained by coding specific combinations of data and clock bits. The special combinations of data and clock bits can be decoded as any binary pattern. It will then trigger recognition of an index address mark or an ID address mark, or a deleted address mark.

Techniques for storing more bits on a single disk usually do so at the expense of precision in timing techniques by eliminating some "redundant" clock bits. Several algorithms are used, to remove some of the clock bits whenever an appropriate succession of bits is present. This saves space, and allows, for ex-example, double density recording.

Accessing data

Whenever a program needs to access data on a mass memory device such as a disk, it requests a read or a write from a file. A file is a logical collection of information, storing one or more sectors. A software and a hardware interface are necessary to provide required facilities. The software interface is the FMS, or file management system. It translates the symbolic file name address into the actual physical address of the sector (s) on the disk. Once it has generated the sector and track address, the hardware interface, or disk controller, will be responsible for performing and controlling the actual access.

The disk drive itself is responsible for implementing the commands from the controller and supplying the required status information. When a sector and a track have been specified, the single read/write head, analogous to a tape recorder head, moves along a radius of the disk until it is correctly positioned over the designated track. When the head has been positioned over the proper track, it must wait for the desired sector to come underneath it. The head will be applied to the diskette, and the sector number will be obtained by information from the timing track, or perhaps through hole detection if hard sectoring has been used. Once the correct sector is known to be under the head, the first block of the sector will be read. The first block is the identification block and it provides the user with track number and sector number which are then verified. If these numbers are correct the transfer will be performed on the following 128 bytes of data. This naturally implies that the controller is equipped with a 128-byte block of memory, called a buffer. Sometimes this block is transmitted directly to the memory of the microcomputer; sometimes it is stored in the controller buffer. This simplified description should be sufficient for the purposes of understanding disk accesses. For more detailed information, the reader is referred, for example, to Sybex's Microcomputer Interfacing Techniques.

Disk types: A Summary

The hard disk, was, for a long time, the only type of disk available for large scale computers. The advent of low cost microcomputers created a need for more limited mass storage media which would be more economical than the hard disk. The floppy was born, and later the mini-floppy. The mini-floppy provides 89K per mini-diskette. The regular floppy provides 253K bytes per diskette. These numbers are indicative, only, as actual capacity is a function of the formatting used as well as of the recording technique. Both the mini-floppy and the floppy are characterized by relatively very slow average access times, on the order of several hundred milliseconds. Most floppy disks are usually formatted according to the IBM 3740 format in 76 tracks plus an index track, with 26 sectors per track.

Two other types of floppies are also available. The first one is the dual-sided floppy where both sides are being used. This method provides twice the data but is much more costly because it requires two heads. The second is the dual density floppy where twice the quantity of data is recorded on the disk. However this has an adverse impact on the reliability of the data being stored.

For most hobby-type applications, the mini-floppy is, at present, an ideal compromise offering a mass memory sufficient for all typical files used in a home environment. Two other advantages are a tolerable access time, and low cost (few hundred dollars per disk).

For any application requiring extensive file manipulations, such as with slow business systems, regular floppies are a necessity. They provide an acceptable storage capacity, although still limited by slow access times.

An ideal solution for business systems is clearly the hard disk. However, for the time being, its cost is still too high. New developments of Winchester-type disk drives promise availability of hard disks in the near future which, probably, will be available at competitive prices.

(Part II in this series will be a discussion of the actual details of interfacing a disk to the microcomputer system.) □

Profitable Personal Computing

How to Profit From Your Personal Computer, by T.G. Lewis; $7,95; *Basic BASIC,* by James S. Coan; $8.95 paperback; Hayden Book Company, Inc., Rochelle Park, NJ 07662.

Two recent books from Hayden Publishing Company contain subject matter of special interest to the average computerist. Author T. G. Lewis, in his preface to *How to Profit From Your Personal Computer,* says: "My goal in writing this . . . was to convey the important features of personal computers useful to computer aficionados. This includes the ability to select equipment intelligently, to analyze, in global terms, a problem for a business application, hobby or educational experiment, and to translate problem situations into real computer sytems. Specifically, I hope the reader will learn how to configure a system to fit the needs of an application; to implement that system using the programming techniques I have developed, and to understand the fundamentals of data processing." How well the author carries out his lofty objectives can be seen from the following program on an actual budgeting and accounting program for one particular month. All transactions are carried out at the end of the monthly period by entering date of transaction, check number, purpose of check and amount of check into the computer along with account number. The example shown is for the month of July and the output is called by Lewis his "Chart of Accounts for File". Item 101 shows how little teaching pays even though payday is twice per month. The university issues a check numbered 96 on the first and 15th of each month. Item 102 shows that the royalties from Hayden Books was $230 – $20 less than the budgeted amount of $250. During the month, the Lewis family spent $172.54 on food, against its budget of $200. Checks recorded for that period, which provided the figure of $172.54, are shown issued to A&P, Safeway and Minimart ("for a keg of beer" confides the author). The total food expenditure is shown in item 201. The final totals printed at the bottom of the income statement show a surplus balance of $53.61 for the month. "This fortunate circumstance," gloats the author, "occurred because the family stayed home all month and spent very little on health, education or welfare." Other subjects treated in the book, which should make it a profitable acquisition for those seeking ways to put their computers to work, include: *Design of a Mortgage Program, Mailing Lists, The Post Office and Disorder, Put Your Computer Where Your Money Is* and others.

In the second book *Basic BASIC* by James S. Coan, © 1978 by Hayden Book Company, Inc., the author combines computer programming using BASIC with the teaching of mathematics. The book presupposes that the reader already has a sturdy knowledge in algebra for the first seven chapters of *Basic BASIC* and a precalculus awareness for the later chapters. The basic function of all computers is to perform mathematical routines whether one is playing Tic Tac Toe or trying to solve an algebraic problem. How nicely author Coan develops this premise in the book is seen in the list of problems at the end of Section 13-2 of *Basic BASIC.* The intent is that the reader will be able to perform these problems after proper study of preceding material in the section on elementary probability:

- You have 25 different books and two bookshelves, one of which holds exactly 12 books and the other holds exactly 13 books. In how many ways can the books be arranged on the shelves?
- How many different words can be formed from the letters of the word COMPUTERS if 1) you must use all of the letters and 2) you must leave out one letter?
- A class consists of 30 students of which 17 are girls. In how many ways can we select a committee of four? How many will have two boys and two girls? How many will have one boy and three girls? How many will have four girls? How many will have four boys?
- How many outcomes are possible for rolling two dice followed by drawing three cards from a 52-card deck?

– Reviewed by Harry Shershow

Computer Failure and Energy Shortages: Effects of Power Problems on Computer Operations, by Henry H. Petersohn; The Technology Press, Inc., PO Box 125, Fairfax Station, VA 22039; 192 pp.; $25 softback.

This book is a reference for management making decisions where computers, minicomputers, microcomputers or word-processing equipment are involved. The book describes computer failures caused by power aberrations, ways of determining the costs of such problems and procedures for solving them.

According to the author of the foreword, data center personnel "can no longer take the AC power requirements for granted. Conversely, they must now scramble in order to educate themselves on how to deal with their own power situation. Information relative to power pitfalls is scarce, and expertise in the field is limited to a few hundred people at the most."

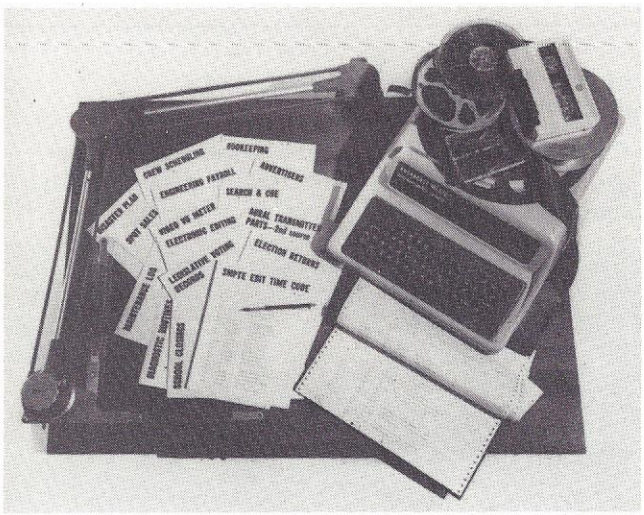
Dr. Petersohn discusses the effects of energy shortages on electrical power and consequently on computer-based equipment. He describes how to detect power-induced failures and how to distinguish between power-induced failures and failures due to other causes. The author's discussion of the economics of such failures covers revenue loss, overtime pay, repair of equipment, restoration of files and data, intangible losses and consequential losses. The author introduces a management model for studying a power problem and reaching a cost-effective solution. The format for a report, advice on how to review a study and sample pages from a power failure study may help you to conduct a power study.

WHAT'S COMING UP

SYSTEMS

New System for Broadcasting

J.S. Wiener and Associates offers a hardware/software system, WRITE, which generates synchronized edit time code signals in accordance with SMPTE edit time code stan-



dards. Through use of this code, videotape or film editing can be greatly simplified, the company said.

A self-contained unit is available ready to plug in and go. Prices range from less than $2500 for a computer with 8 channel read/single channel write program in firmware.

For more information contact J.S. Wiener and Associates, Broadcast Services Group, 4440 N. Kedzie Ave., Chicago, IL 60625; (312) 478-2666. *Circle No. 101*

System from MicroDaSys

The $549 MicroDaSys System 1 Kit features custom console, keyboard, S-100 bus motherboard, 16 amp power supply, fan, 64 X 16 upper and lower case video/graphics card, and the MD-690A CPU board. Assembled price is $699.

The system combines the 6800 processor (6802) with the S-100 bus. Features include a 2400 baud cassette interface, 10K PROM space, 1K RAM, 20 I/O bits, an RS-232 and interrupt driven keyboard input.

The 1K PROM monitor (MONBUG) at the heart of The System is compatible with the standard 6800 ROM (MIKBUG). As a result, virtually all 6800 software will run on The System. MONBUG outputs to memory-mapped video cards, permitting graphics and animation.

MD-690A is upwards compatible with the third generation Motorola 6809 processor chip. The 6809 offers 16-bit internal arithmetic, hardware multiplication and 18 addressing modes.

System 2 adds a 32K RAM card with 8K of RAM and is priced at $699 (kit), $899 (assembled). Each 8K additional RAM is $129.

System 3 combines a full 32K Static RAM with a minifloppy disk drive, controller and DOS. The System 3 is available for $1499 (kit) or $1799 (assembled).

For further information contact MicroDaSys, P.O. Box 36051, Los Angeles, CA 90036; (213) 935-4555. *Circle No. 102*

Information Management System

Better Programming Systems, Inc., now offers a complete information management system featuring relational data base, report writer, query and update functions, one megabyte mass storage, CRT with full-sized keyboard and numeric pad, 125 lpm and upper/lower case printer for $12,000 total.

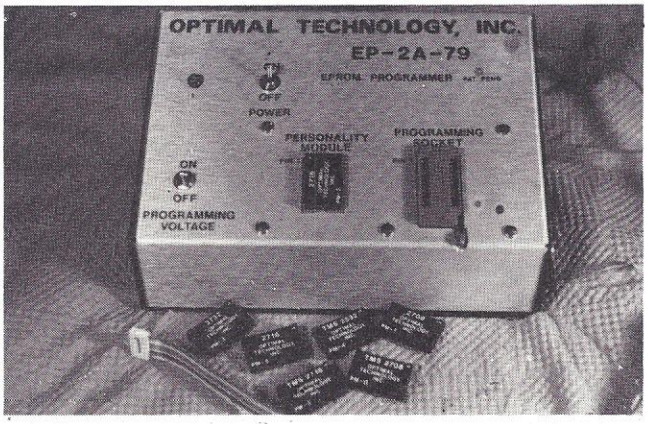
Called the BPS, this system is designed for small business applications. The system runs on an Ohio Scientific Challenger III microcomputer with dual-sided floppy diskettes. Expansion to include COBOL and FORTRAN is available. Mass storage can be upped to three hundred megabytes. The high quality printed characters are suited for the optional word-processing package.

The user has the ability to edit data files, enabling the maintenance of current transactions without the assistance of a specially hired programmer. Changes in routine procedures can be reflected in report formats immediately without any inconvenience or expense, said the company.

For more information contact Better Programming Systems, Inc., 275 Fort Washington Ave., New York, NY 10032; (212) 781-1861. *Circle No. 103*

EPROM Programmer Spans Eight Microcomputers

Optimal Technology has announced the EP-2A-79, EPROM Programmer. Software for programming and verifying programming is available for the 6800, 8080, Z-80, 8085, 6502 (KIM-1), F-8, 1802 and 2650 based microcomputers. Packaged in a sloping panel aluminum case, the unit



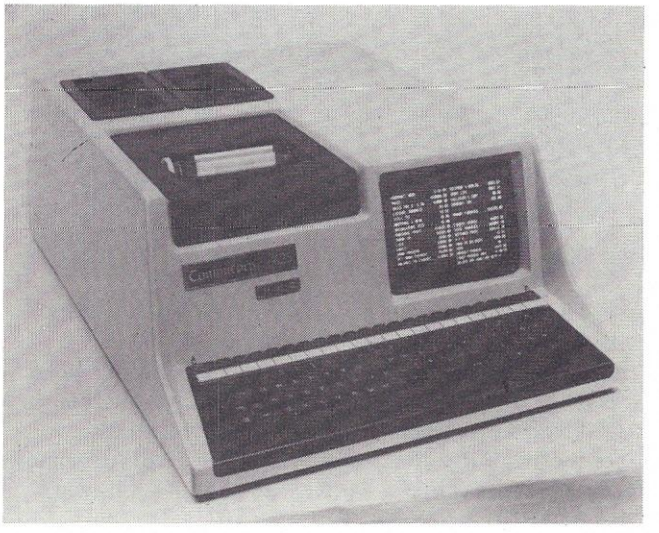
connects to the microcomputer with a 14 pin ribbon cable through 1-1/2 I/O ports. Software, supplied as a listing, requires approximately 256 bytes of RAM and includes in-

structions on how to relocate. Personality modules which plug into the front panel-mounted socket are available for programming the 2708, 2716, TMS 2716, 2732, TMS 2708 and TMS 2532 EPROM Power requirements are 115 VAC 50/60 Hz at 15 watts.

The EP-2A-79 is priced at $145, which includes one set of software. Personality Modules are priced at $15 except the modules for the 2732 and TMS 2532, which are $25. For more information contact Optimal Technology, Inc., Blue Wood 127, Earlysville, VA 22936; (804) 973-5482. *Circle No. 104*

Desk-top Computer with BASIC and Built-In Peripherals

Designed for scientific and business users, the Compucorp 625 Mark II Desk-top Computer incorporates display, memory and hard-copy peripherals in a single unit. Based



on a Z80 central processor, the 625 Mark II offers an extended BASIC language operating system and up to 60 Kbytes of internal RAM. Dual flexible disk drives store up to 630 Kbytes of data. These drives can be used for both program and data storage.

Compucorp offers a number of software packages (including a Word Processing and Text Editing module) on disk for both business and scientific applications.

The system contains a 1280 character CRT display (16 lines of 80 characters) as well as a 40-column alphanumeric matrix printer. The printer can provide multiple copies on plain paper and variable character sizes. Limited graphic capability is available with the use of 64 graphic characters on the CRT

Mark II has a full size typewriter-style alphanumeric keyboard, as well as a 10-key numeric key pad. Twenty special keys are available for use as 60 special functions.

Five-board slots inside the unit provide a variety of interface options. The computer can be used as an instrumentation controller by inserting the IEEE-488 bus option or any of four other controllers. Instrumentation and process control users will find the Analog/Digital-Digital/Analog interface with internal multiplexer and the 32 Line Parallel

interface useful. For connection to external peripheral devices and data communications, a Dual Serial Communications Controller is offered. CMOS memory and real time clock are available for powerful memory protection, accurate timing and calendar maintenance. An S-100 interface provides compatibility with a variety of interfaces and devices.

Also available in a 19-inch rackmount version, the 625 Mark II starts at $8000. For more information contact Compucorp, 1901 S. Bundy Dr., Los Angeles, CA 90025; (213) 820-2503. *Circle No. 105*

Pascal Microengine from CIT

A Pascal Microengine incorporating the full University of California at San Diego Pascal Operating System is being marketed by Computer Interface Technology. The operating system includes Pascal compiler, BASIC compiler, file manager, screen-oriented editor, debugger and graphics package. Other features of the microengine are 64K bytes of RAM, two RS-232 asynchronous ports, two 8-bit parallel ports, floppy disk controller and ASCII console.

Price is $2995; the first 500 orders receive an introductory price of $1995. For more information contact Computer Interface Technology, 2080 South Grand, Grand Center, Santa Ana, CA 92705; (714) 976-9920. *Circle No. 106*

Escrow Business Administration Systems

AIC has released an Escrow Business Administration (EBA) System designed to reduce the administrative costs

and problems which exist in many California escrow and real estate offices.

Daniel Hancock, president of AIC, said this system will greatly speed up the processing of escrow transactions, simplify the closing process and provide better overall control of an escrow office's dollars and documents. The same system can also eliminate the need for separate word processing machines.

The EBA System consists of a microcomputer mounted

in a desk, a video display terminal, a high-speed printer and a package of computer programs. The memory of this system is provided by floppy diskettes. The video terminal allows viewing and correction of escrow information at speeds up to 960 characters per second. One of the two standard printers provides typewriter-quality reports and letter-perfect documents at 55 cps. A 120 cps matrix printer is also available.

The EBA can be either purchased or leased. The lease costs of the four EBA models range from $2.36 to $2.87 per hour on a 40-hour work week basis.

For more information contact Mr. Hancock at Adventures In Computing, Inc., 8756 Warner Avenue, Fountain Valley, CA 92708; (714) 848-8388. *Circle No. 107*

Plotting in XPL

New England Digital Corporation has introduced three plotting packages for its Able minicomputer.

The plotter packages are available in three different versions to suit different applications. The basic system, designated GS-1, uses a high performance digital plotter that offers a 7" by 10" plot size on 8-1/2" by 11" paper with 0.005" resolution. A comprehensive software package is included that provides for line generation, scaling, axis labelling and lettering using simple statements in XPL. The complete GS-1 system costs $2500, with educational and quantity discounts available.

A second system features a larger incremental plotter that provides a 10" by 15" plot on 11" by 17" chart paper with 0.005" resolution. This larger scale allows for more accurate curve representation. The price for GS-2 complete with interface and software is $5500.

A third system uses a digital plotter with continuous feed Z-fold paper. This feature allows continuous plots up to 144 feet long. A plotting window 11" wide is provided with 0.005" resolution. Price for GS-3 is $7000.

For more information contact New England Digital Corp., P.O. Box 305, Norwich, VT 05055; (802) 649-5183. *Circle No. 108*

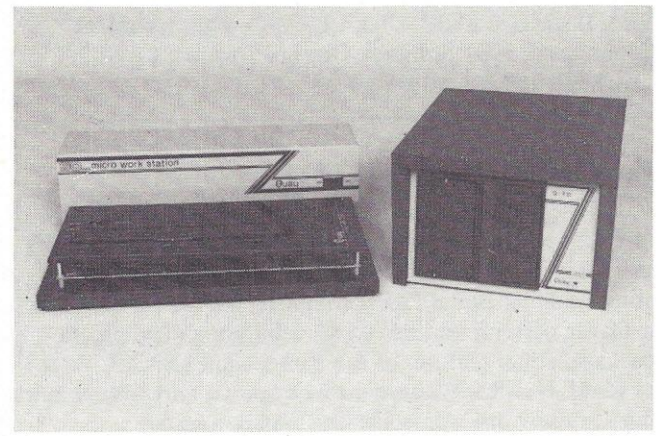
Microcomputer Work Station

The 90 Micro Work Station (MWS) is a desk top microcomputer system that provides an enclosure plus convenient access to the microcomputer board facilities. The 90MWS is well suited for system development, personal computing, or as an educational system for microcomputer instruction.

The station includes the Quay 90MPS or 90F/MPS single board microcomputer, complete power supply for 50/60 Hz operation and wood grain base with hinged plexiglas protective cover. 90MPS board-resident facilities include: Z80-CPU, up to 65 Kbytes of dynamic RAM, up to 14 Kbytes of ultraviolet erasable PROM (2708/2716), PROM programmer, 1 Kbyte of static RAM, up to eight 8-bit programmable I/O ports, four programmable counter/timer channels, an RS232C or 20 ma serial port with selectable baud rate, 2.5 or 4 MHz operation and a PROM resident system monitor with debug capabilities. The 90F/MPS microcomputer board also includes a DMA-based floppy disk controller that supports up to four multidensity drives.

Accessories for the 90MWS include a floppy disk subsystem compatible with Digital Research's CP/M and an S100 bus adaptor for additional peripheral expansion.

Single unit prices for the work stations are: 90MPS based with 4KB dynamic RAM $1050; 90F/MPS based with 16KB



dynamic RAM and floppy disk interface, $1675. For more information contact Quay Corporation, P.O. Box 386, Freehold, NJ 07728; (201) 681-8700. *Circle No. 109*

New Line of CSD Computers

Computer Systems Development, Inc., has introduced four new computers for small business and distributed processing applications. Sentinel Model 10 is a stand-alone data entry work station with 32K of memory, 1920 character CRT and two double-density 800,000 character floppy disk drives, integrated into an attractive hand-crafted wood desk module. Model 20 offers the same features plus 64K of memory in the CPU and a 150/180 CPS 132 column printer.

Adding a Winchester-type hard disk drive with storage capacity of 14.5 million characters and a 300 lpm printer to the Model 20 creates the Model 30. Model 40 substitutes a 29 million character fixed disk drive to the Model 30's configuration.

Retail prices for the Sentinel Models 10, 20, 30 and 40 have been set at $9950; $19,900; $24,900; and $34,900, respectively.

CDS's catalog also includes printer stands, CRTs, diskettes and data base processing software. Double-sided, double-density floppy disk drives with 1.6 megabyte of storage are also available.

For more information contact CDS, Inc., 4154 Crossgate Dr., Cincinnati, OH 45236; (513) 984-6622. *Circle No. 110*

AD/380 Graphics Systems Expanded

Auto-Trol Technology Corp. has expanded its AD/380 family of interactive graphics systems with the new CC-80 graphic work station, offering a CRT with refresh and simultaneous storage display.

Intelligence is provided to the CC-80 through a microprocessor, relieving the burden on the host CPU. CC-80's human factors design consolidated several system devices including: choice of 19" or 25" graphic CRT with elevate and swivel controls; 9" alphanumeric CRT with selectable screen formats; local and remote communications capability; and up to four 240 position menu function keyboards per station.

Basic AD/380 software capabilities include GS-100 for production drafting, GS-200 for engineering design and manufacturing and GS-300, a flexible combination of GS-100 and GS-200.

For more information contact Auto-Trol Technology Corporation, Marketing Department, 5650 N. Peco St., Denver, CO 80221; (303) 458-5900. *Circle No. 111*

Data Acquisition System Features Expandable Multibus

An integrated hardware/software data acquisition system for industrial and scientific applications is available from Computer Marketing, Inc. The MB 80 DAS is a programmable data acquisition system featuring four Multibus user expansion slots for adaptation to a range of tasks. It is supplied with a software operating system; the user writes the control programs. The system can be configured with opto isolators, hard/soft disks, relay drivers, IEEE interface, D/A converters and up to 256 channels of A/D.

The unit incorporates an 8080 micorprocessor, 16K bytes of RAM and an 8K EPROM monitor with on-board diagnostics and bootstrap loader. There are 48 programmable I/O ports, a serial I/O port, and 16 channels of analog input. The MB 80 DAS also comes with a 10-1/2", 9 track, 800 BPI, 45 IPS tape subsystem; 30 amp, +5V power supply; full ASCII keyboard; 9" CRT monitor; line time clock; and key lock control.

The system with software costs $12,725. For more information contact Computer Marketing, Inc., C. E. Guenther, Product Manager, 237 Crescent Street, Waltham, MA 02154; (617) 894-7000. *Circle No. 112*

1280 Pixels/Line X 1024 Lines Computer Graphics System

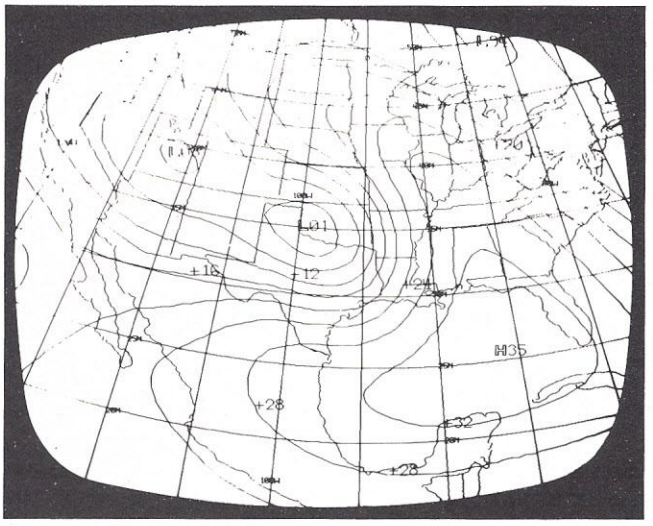
Allowing use of the full CRT screen, a high resolution 1280 pixels per line by 1024 lines (1,310,720 points) raster computer graphics display system has been made available on a standard production basis by Genisco Computers.

According to the company, the system's ultra-high density provides detail clarity and minimizes distortion and the "stair-step" visual effects of computer raster display systems.

Included in the system is Genisco's Programmable Graphics Processor, which provides high speed graphics manipulation (150 nanoseconds internal cycle time; 4 cycles maximum instruction time) and has a set of 55 mnemonic instructions.

This system also contains a high-resolution CRT includ-

ing cables, a Monitor Control module, 16K MOS/RAM Refresh memory, interfacing for most popular CPUs and com-



prehensive Graphics Operating System software. In addition, a Cross Assembler software package written in FORTRAN IV is optionally available.

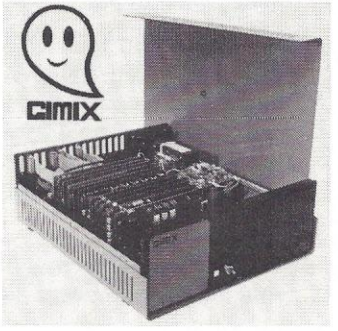
The expandable system can operate up to 12 monitors from a single system; and TV camera input is available for mixing video signals with computer stored graphic data displays.

A range of special optional features and RS232 compatible peripheral interactive devices – including a 64 programmable functions keyboard, a X-Y-Z input Joystick, an 11" X 11" graphic data input "Tablet", and an X-Y positioning "Trackball" – are also available.

According to the company, system applications include seismology, medical x-ray enhancement, command and control, simulation, process control, weather mapping, computer-aided design, animation and test systems.

For more information contact John Fletcher, Genisco Computers, 17805 Sky Park Circle Dr., Irvine, CA 92714; (714) 556-4916. *Circle No. 113*

Gimix System 68

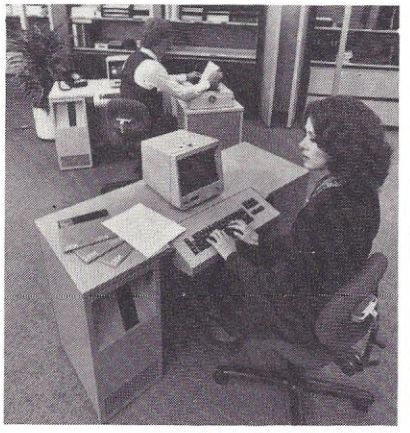


Gimix, Inc., the company that manufactures Ghost power control systems, now offers a System 68 microcomputer. The system features a ferro-resonant constant voltage power supply; an SS50 motherboard (15-50 pin and 8-30 pin gold plated slots); a 6800 CPU board that holds 4-2708s and 3 independent programmable software timers; and Gimix 16K software readdressable static RAM boards organized into 4 separately controllable 4K blocks, which allow the user to have as much memory as can be contained in the mainframe. DIP switch features allow use of existing SWTP and MSI compatible software.

This system uses the Gimix video board and GMXBUG 3K ROM monitor that contains standard utility functions plus routines for software development.

For more information contact Gimix, Inc., 1337 W. 37th Place, Chicago, IL 60609; (312) 927-5510. *Circle No. 114*

IBM Offers Low Cost Office System 6 Information Processor



A low-cost, stand-alone information processing unit has been added to the IBM Office System 6 product line. Called the IBM 6/420 Information Processor, the new unit provides capabilities for editing and compiling text and records. It also includes the same functional display, high-density diskette storage and 96-character keyboard of other IBM Office System 6 models.

The IBM 6/420 Information Processor is designed for Office System 6 environments with high-volume information entry and processing requirements, but where magnetic card capability and printing are not required at all stations. Text and records are displayed as they are entered and recorded on diskettes for printing on other Office System 6 models. Information can be read into the processor from other diskettes for additional revision.

According to IBM, the system offers users flexibility and speed in performing document assembly, global search/exchange and field update. Document assembly permits one-page or multi-page documents to be assembled without operator assistance; global search/exchange enables characters or phrases to be searched either by word or character string for addition, deletion or exchange; field update permits files to be updated and maintained automatically.

An optional communication feature allows communication over telephone lines with the IBM 6/452, 6/450, 6/442, 6/440, and 6/430 Information Processors as well as the IBM 6640 Document Printer, the IBM 6240 Mag Card Typewriter – Communicating, the IBM Mag Card II Typewriter–Communicating, the IBM Word Processor/32 and suitably programmed computers.

A self-teaching instruction program provided with each processor enables operators to learn at their own pace, the company said.

Purchase price is $9390. Monthly charges under the three-year lease plan are $295; under the two-year plan, $310. Under the rental plan, monthly charges are $350.

Purchase price for the optional communications feature is $4270. Monthly charges under the three-year lease plan are $102; under the two-year lease plan, $107. Under the

rental plan, monthly charges are $122. The cost of an internal modem or an interface for use with external modems is additional.

For more information contact IBM, Office Products Division, Parsons Pond Dr., Franklin Lakes, NJ 07414; (201) 848-3454. *Circle No. 115*

PERIPHERALS

Acoustic Coupler/Modem from Tek-Com

Tek-Com, Inc., has announced the TC3002, a Bell compatible 103F and 113A acoustic coupler modem. The TC3002 has been designed to optimize the transfer of low-speed data over normal voice grade telephone lines using an ordinary telephone handset, said the company.

Specific design and operational features include: 300 baud asynchrouous data rate; originate and answer modes, switch selectable; acoustic and DAA/private line interfaces; half/full duplex; simultaneous EIA and 20mA interfaces; power and carrier interfaces; and accuracy and stability over wide variations in temperature, data rate, line voltage and received signal amplitudes.

Unit price is $295. The unit weighs less than four pounds, with dimensions of 10-1/2 "x 7-1/2 "x 3-3/4 ".

For more information contact Tek-Com, Inc., 1147 Sonora Ct., Sunnyvale, CA 94086; (408) 736-3282. *Circle No. 116*

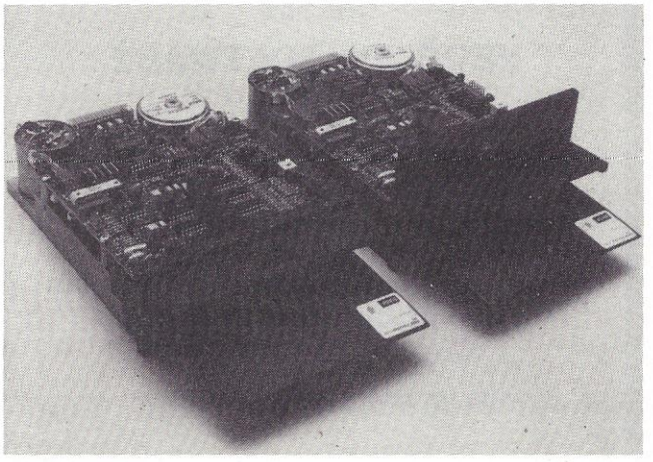
5.25-Inch Mini Disk Drive

The BASF 6106 5.25-inch floppy disk drive is now being produced by BASF Systems.

The 6106 offers 40-track capacity and has a rapid track-to-track access time of 12 msec. The drive can be operated in both FM and MFM recording modes and provides up to 250,000 bytes of unformatted capacity on one side of a floppy disk.

The BASF 6106 is plug-compatible with the Shugart SA-400. A front-plate is available to cover the gap left by the

smaller BASF drive. The disk drive offers systems-oriented options such as software-controlled door interlock, head-



loaded activity LED and a head-load control separate from the select control.

The BASF 6106 is priced at $450 in single quantities. For further information contact Computer Products, BASF Systems, Crosby Drive, Bedford, MA 01730; (617) 271-4000. *Circle No. 117*

Terminal and Printer Series from Diablo

Diablo Systems, Inc. has announced its Model 1640 series of terminals and printers, designed to use a plastic daisy wheel and available in three configurations: keyboard send/receive terminal, receive only terminal and an OEM printer mechanism. The series features the Diablo-designed universal interface which permits serial and byte parallel communications interfaces.

Other standard features include programmable line spacing, pitch, margins, tab control and graphics capability; a 256-character buffer; and self-test diagnostic maintenance routines.

A series of enhancement options is also available. Firmware options include automatic underscore, automatic bold overprint, automatic shadow printing, automatic proportionally spaced printing, automatic right margin justification, automatic line centering, 2741 communications protocol, HyPlot vector graphics, APL and external diagnostics.

Hardware options include power supplies, control panel, type of cover set, forms tractor, option board, current loop interface, expanded buffer, special keyboards including APL and logical bit and forms handling equipment.

Deliveries will begin in April 1979. Price for the KSR version in large quantities is $2280 each. For more information contact Bob Burks, Diablo, 24500 Industrial Boulevard, Hayward, CA 94545; (413) 786-5207. *Circle No. 118*

Combination Floppy Disk and S-100 Adaptor for PET

The EXS-100 from CGRS Microtech provides a combination floppy disk controller and S-100 Adaptor for the PET computer. The EXS-100 is a single S-100 size printed circuit board that connects to the PET memory expansion socket with a flat cable. The board can then be plugged into any S-100 mainframe for expansion to the popular S-100 bus. Up to 3 minifloppy disk drives plug directly into the EXS-100.

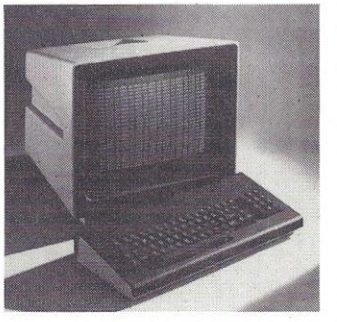
As a floppy disk controller, the EXS-100 uses the standard IBM 3740 format and will drive up to 3 minifloppy disk drives for up to 240 kilobytes of storage, said the company. A special software package is available that allows the PET user to load and store programs from the disk. The EXS-100 board also has provision for EPROM storage onboard, so that the disk software will be instantly available.

As an S-100 adaptor, the EXS-100 is fully buffered and generates the full compliment control lines. A compatibility listing is provided along with the instructions so that the PET user can take advantage of various S-100 boards available, including voice generators, analog input, printer, plotters and telephone interface cards.

The EXS-100 is available in three versions: 1-EXS-100 assembled as an S-100 adaptor for $199.95; 2-EXS-100 assembled as a disk controller for $299.95; 3-EXS-100 assembled as a combination S-100 adaptor and disk controller for $349.95. The board is also available in a complete disk package for $799.95.

For further information, contact Joe Swope, CGRS Microtech, P.O. Box 368, Southampton, PA 18966; (215) 757-0284. *Circle No. 119*

Ann Arbor Terminal



Ann Arbor Terminals has announced a terminal that emulates the code structure and functions of the Lear Siegler ADM3A. Ann Arbor's Model ADM3A-COMPAT features a large 15-inch nonglare screen, detached keyboard and upper/lower case characters. There is no repeat key (all keys are typamatic) and no control switches (all operating controls are set from the keyboard).

The terminal measures 15"W x 14"H x 13.6"L, plus keyboard; weight is 35 lbs. The unit displays 24 lines of 80 characters and operates in Roll mode. Characters are formed in a 7x7 dot matrix in a 10x10 dot field. The cursor is a reverse field.

The Model ADM3A-Compat has a 72-key detachable keyboard which generates the full 128-character ASCII set. A separate numeric pad and cursor control keys are standard. Use of the Shift and Control keys is identical to the ADM3A. Up to 36 special function keys are also available.

All commands and controls may be executed from the keyboard. Commands are Erase screen: Cursor home, return, up, down, right and left; Set cursor position; Bell and Lock or Unlock keyboard. Control functions are selection of baud rate (110 to 9600), I/O mode (full or half-duplex)

and keyboard mode (TTY or full-ASCII).

Available options include export power, automatic line-feed, current-loop interface and rack-mounting panel, as well as a variety of case options. Single quantity price is $1400. For further information contact Sarah Freeman, Marketing Coordinator, Ann Arbor Terminals, Inc., 6107 Jackson Road, Ann Arbor, MI 48103; (313) 769-0926. *Circle No. 120*

CRT Terminal from AJ

Anderson Jacobson, Inc., has announced the AJ 510, a terminal featuring a 15" CRT monitor displaying 24 lines of 80 columns each. Characters are formed by a 7 x 10 dot matrix in a 9 x 12 character cell.

The AJ 510 is designed for operator convenience, ease of operation and high data throughput, said the company. It comes equipped with a typewriter-style keyboard with an alphanumeric section, cursor control pad, numeric pad and terminal control keys. Two character sets are standard with the AJ 510 – the full 128 character ASCII set and a 40 character graphics set. The terminal can also be equipped with an optional APL character set and keyboard. The AJ 510 provides 16 different video enhancements, cursor addressing and sensing, protected and unprotected fields for forms applications, full editing capabilities and self test diagnostics.

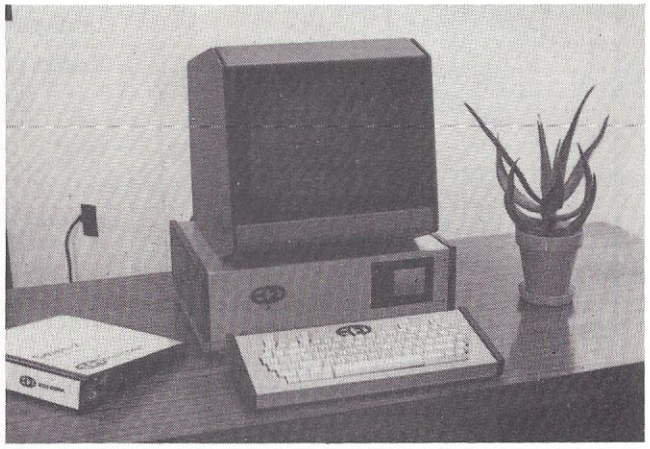
For rapid throughput, data can be transferred asynchronously from the AJ 510 via its RS 232C ports directly to a serial printer and/or through a full duplex or half duplex modem. Data rates are switch selectable from 110 to 9600 bps.

For more information, contact Anderson Jacobson, Inc., 521 Charcot Avenue, San Jose, CA 95131; (408) 263-8520. *Circle No. 121*

Programmable Intelligent Terminal

The Smart ASCII-2 Programmable Intelligent Terminal from ECD Corp. automatically loads its program from a built-in minicassette drive when it is turned on. This feature

provides the convenience of a ROM based system, while allowing easy changing or updating of the system programs, the company said. The standard intelligent terminal/word



processing program can be easily modified to emulate different protocols, character codes, character sets or other specific terminals. Because the character set is also loaded from the minicassette, foreign languages can also be accommodated.

In addition to the terminal program, a version of BASIC is also provided to run in the Smart ASCII-2. It can be run stand alone or in communication with other computers. BASIC can also be used to control the RS-232 interfaces, the serial or parallel I/O lines, or the analog I/O lines, all of which are standard with the system. In this fashion, the terminal can be used as a remote intelligent controller and interface to a wide variety of other equipment, said the company. The standard Smart ASCII-2 includes a 15 "CRT, an 80-key relegendable keyboard, processor unit with 37K of memory and a minicassette drive with tapes for intelligent terminal and BASIC programs. Price is $7700 for singles. A variety of options are available. For more information contact Richard Eckhardt, ECD Corp., 196 Broadway, Cambridge, MA 02139; (617) 661-4400. *Circle No. 122*

Imsai Announces Hard Disk

Imsai introduced the HD-10 Hard Disk Systems, featuring the CDC Hawk Model 9427H hard disk. HD-10 provides 10 megabytes of formatted on-line storage per unit.

The 9427H random access storage device uses a single fixed disk for 5 megabytes of storage. An industry standard 5440-type removable disk cartridge provides an additional 5 megabytes of storage. This removable media capability allows for file back-up and unlimited off-line storage.

HD-10 is compatible with all Imsai 8080/85-based microcomputers. The system employs a single S-100 bus I/O board to interface with up to two external disk controllers. Each controller supports up to four hard disks. Therefore, any Imsai system may be expanded to 80 megabytes of hard disk storage with only one I/O card.

Included with the HD-10 system is the new IMDOS II operating system. Any applications written under IMDOS will run under IMDOS II with little or no modification by assigning the hard disk as the logical device used by the application. All of Imsai's utilities and languages will also run. IMDOS II is compatible with other versions of IMDOS and CP/M Version 1.33.

For more information contact Imsai Manufacturing Corp., 14860 Wicks Boulevard, San Leandro, CA 94577; (415) 483-2093. *Circle No. 123*

Storage Technology's Double Density Disk

Storage Technology announced its STC 8650 double density disk drive, which offers 635 MB of data storage per spindle by doubling the track density from the standard STC 8350. The new unit comes in the same physical dimensions as the earlier STC 8350.

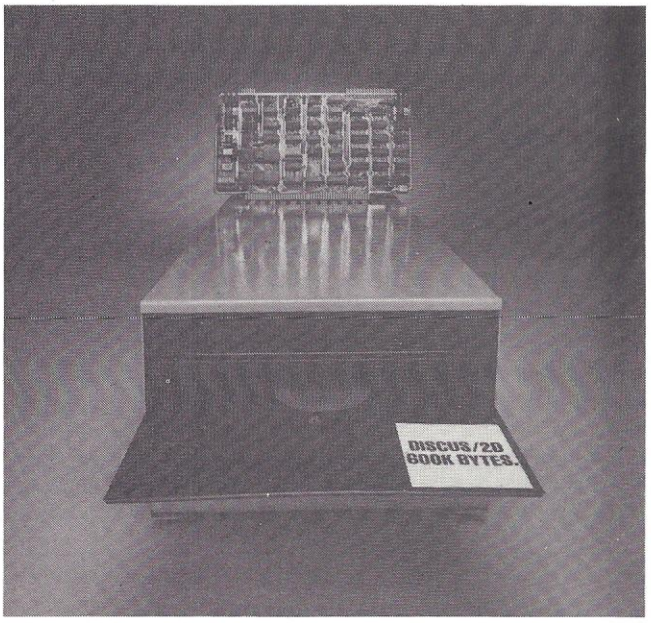
For more information, contact Tom Purtell, Storage Technology Corp., 2270 South 88th St., Louisville, CO 80027. *Circle No. 124*

Single/Double Density Disk System

Thinker Toys has introduced DISCUS 2D, a full-size, single/double density disk system capable of storing up to 600K bytes of data on each side of a diskette which is formated to be compatible with the IBM System 34. Like the original single density DISCUS I, DISCUS 2D comes assembled with a controller board and a Shugart SA800R full-size drive mounted in a cabinet with a power supply.

The S-100 controller board utilizes the Western Digital 1791 dual-density controller chip and also has power-on jump circuitry, 1K of RAM, 1K of ROM with built-in monitor and a hardware UART with a baud rate generator to simplify I/0 interfacing. It can handle up to four drives.

Software includes BASIC-V virtual disk BASIC, DOS and



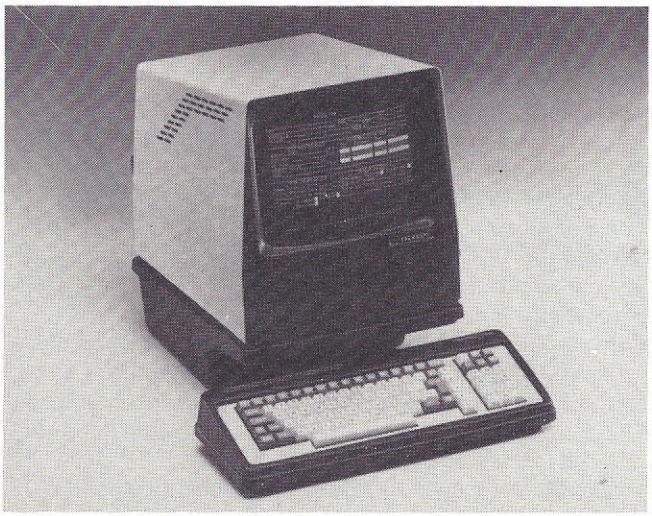
Disk/ATE assembler and editor. Extra cost optional software including CP/M, Microsoft Extended Disk BASIC and Fortran is available.

Price is $1149 for the completely assembled single/double

density system and $795 for each additional drive. For further information, contact Thinker Toys, 1201 - 10th St., Berkeley, CA 94710; Hilda Sendyk, (415) 524-2101. *Circle No. 125*

Improved Terminal Offers 32 User-Programmable Functions

The Teleray Division of Research Inc. has announced that the Model 1061 terminal now has the capability of storing up to 32 operator-programmed or down-loaded function messages, totalling up to 527 characters.



All 32 functions (forms, control sequences, answerbacks or any ASCII message) may be entered and called up by a simple escape sequence. Eight of the most often needed functions may be initiated with dedicated keys on the keyboard.

This new and adaptable functions-capability is an add-on to the 1061's list of programmable features, including independent I/O and peripheral speeds, wide/regular character display, formatting with five field modifiers (protect, dim, blink, inverse and underline in any combination) and columnar tab.

Any of the 1061's modules (logic, monitor, power and keyboard) can be replaced in 60 seconds with no tools whatsover, according to the company. Price of the standard Model 1061 is $1090. Customized keyboards and space-saving desk stand are available.

For more information contact Teleray Division, Research Inc., P.O. Box 24064, Minneapolis, MN 55424; (612) 941-3300. *Circle No. 126*

Intelligent Hard-Copy Terminal from Dataroyal

Dataroyal, Inc., has introduced a higher-speed addition to its IPS-7300 line of intelligent hard copy terminals. Priced at $4675 for end users in single unit quantities, the 150 character-per-second IPS-7326 complements earlier units with 120 cps output rates.

Like other members of the IPS-7000 family of intelli-

gent printing systems, the IPS-7326 combines a matrix printer with an eight-bit programmable microcomputer. A movable data input station consisting of a gas discharge display and ASCII keyboard is also standard on the new system.

According to Dataroyal, applications include data logging, factory data collection, label printing and other materials and information handling jobs requiring both computing intelligence and output printing capabilities.

An IBM 2848-compatible serial interface is standard on the IPS-7326 and a 20 mA current loop interface, as well as other serial interface types, are available as options. Deliveries of the new system are 30 days ARO.

Dataroyal said the intelligent printing systems are currently used by *Fortune* 500 companies in the paper, pharmaceuticals, grocery, steel, plastics, tobacco, textile and chemical industries.

For more information contact Dataroyal, Inc., Main Dunstable Road, Nashua, NH 03060; (603) 883-4157. *Circle No. 127*

Acoustic Telephone Coupler

Omnitec Data has introduced model 743 Acoustic Telephone Coupler, designed to operate specifically with Teletype Corporation's Model 43 data terminal. By interfacing

the coupler to the TTL logic of the terminal, need for the optional EIA interface on the terminal was eliminated. The coupler has a data rate of 0 to 450 baud.

Price in single-unit end user quantities is $155 each. For more information contact Omnitec Data, Patricia Anderson, Sales Administrator, 24055 South 20th St., Phoenix, AZ 85034; (602) 258-8244. *Circle No. 128*

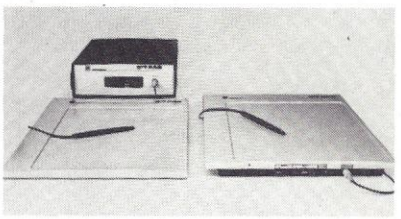
SFE Sound Generator

The SFE sound generator from Integrated Technology is an S-100 bus peripheral that can produce a wide variety of complex sounds under software control. The device can produce tones, noise or low frequency (or a combination thereof) based complex sounds, said the company. The SFE generator is designed for flexibility in user-defined sounds, and may be used for applications requiring audio feedback to the operator. Examples include arcade/home video games, music synthesis, audiographs, audible alarms and FSK modulators.

Constructed on the S-100 bus standard for pin out and physical dimensions, the board can be used with any processor (8080, Z80, etc.) at either 2MHZ or 4MHZ. The audio output from the board can be plugged into any audio amplifier using the coaxial cable assembly provided.

For more information contact Integrated Technology, 519 Prospect Heights, Santa Cruz, CA 95060. *Circle No. 129*

New Version of Bit Pad Digitizer



Summagraphics Corporation has added to its low-cost digitizer, the Bit Pad, with a new one-piece version, the Bit Pad One, a wholly integrated digitizer combining both the tablet and electronics in one table-top unit.

Bit Pad One is a full capability digitizer permitting entry of positional information. Designed for easy, low-cost data collection of X,Y values, the compact unit is portable and adaptable to a wide variety of applications.

The Bit Pad interfaces to a variety of microcomputers via either 8-bit parallel output, RS232 serial communications interface, and IEEE-488 standard interface.

The Bit Pad One, geared for the personal and home computing markets, sells for $666. For additional information, contact Summagraphics Corp., 35 Brentwood Ave., Fairfield, CT 06430; (203) 384-1344. *Circle No. 130*

Price Decrease on Terminal Controller for LA36 DECwriter

Datasouth Computer Corp. has reduced domestic end-user pricing on its DS120 Terminal Controller for the LA 6 DECwriter.

The DS120, designed to upgrade the 300 baud LA36 to 1200 baud, has been reduced from $885 to $750 in single unit quantity. The unit features microprocessor control, 165 cps bidirectional printing, forms control package, EIA and current loop interfaces, and 110 to 4800 baud line operation.

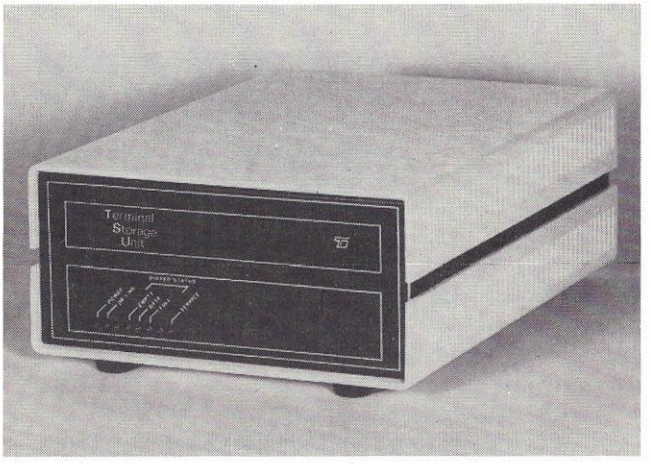
For more information contact Datasouth Computer Corporation, 627-F Minuet Lane, Charlotte, NC 28210; (704) 523-8500. *Circle No. 131*

Tri-Data Terminal Storage Units

Tri-Data has announced a new product line of low-cost Terminal Storage Units. The TSU Series provides variable top of form, programmable answerback and editing capa-

bility for store and forward data communications applications. Data may be stored in the TSU buffer and edited off-line, prior to transmission via an on-line system.

All TSU Models come with TextEdit II software stored



in PROM. The program allows the operator to create and store an Answerback message and vary the number of lines that define top of form. All commands to enter, print or edit data are entered in simple English and include the ability to search and replace data as well as selectively transmit portions of data in three different on-line modes.

The TSU-0 and TSU-1 are single printed circuit boards designed to be used in place of an RS232 interface on Model 43 Teletype printers and have communications ability incorporated into the hardware. The TSU-1 contains approximately 1000 characters of buffer storage. Models 4, 8 and 12 contain 4, 8 or 12K characters of storage and are stand-alone portable units that can be used with any ASCII terminal equipped with an RS232 interface.

The TSU-0 and TSU-1 list prices are $300 and $400; Models 4, 8 and 12 list at $950, $1150 and $1350, respectively. For more information contact Tri-Data Corporation, 800 Maude Ave., Mountain View, CA 94043, (415) 969-3700. *Circle No. 132*

Terminal Attachment System from Sykes

Sykes Detatronics, Inc., has introduced Comm-Stor IV, a BASIC programmable terminal attachment which includes, in addition to BASIC commands, a second command set of data communication and file management functions.

The Comm-Stor IV comes with either a single or dual floppy diskette drive, from 4K to 40K bytes of user program memory and communication ports for connection to an asynchronous RS-232 terminal, printer and modem. The Extended BASIC interpreter, sophisticated file manager and the flexible data communication system are all resident as firmware in an additional 40K bytes of ROM memory. The minimum configuration – with a single diskette drive, 4K of memory and two ports – is priced at under $4000 in single quantities.

According to the company, installing a Comm-Stor IV between a user terminal and a modem can provide many of

the data processing and storage features normally found on timesharing computers, allowing many applications that require remote processing to be handled locally.

Key features of the new Comm-Stor IV include: user programs to 40K bytes; flexible data communications; input data buffering; real-time clock; virtual arrays; CALL and LINK programs; binary data I/O; interrupts to 7 levels; and IBM 3740 data exchange.

Comm-Stor IV is stored on diskettes as files, with individual file names automatically cataloged in a directory. Storing, sorting and retrieving data is easy and rapid, the company said, since the Comm-Stor IV's file management system does all the work. After receiving data from a terminal at low speed, an unattended Comm-Stor IV can send batched data at high speeds over communications lines and can interact with most asynchronous communication protocols. Comm-Stor IV writes data on diskettes in IBM 3740 compatible format, a medium which may be easily transferred between systems.

Comm-Stor IV users have a choice of four file access techniques: sequential file access; sequential with random repositioning; random file access; and physical track/sector access. Regardless of the access technique used, files are recorded continuously on diskette. This feature gives the system higher speed and capacity because the linking overhead and diskette seeks time characteristic of a non-contiguous file system are not necessary.

For real-time application tasks, Sykes designed Comm-Stor IV with a data buffering system as a standard feature. Data input to the terminal and the modem ports is automatically buffered and held until a BASIC program requests it. Each port is assigned a buffer area in memory of up to 32K characters, with the combined two-port buffer maximum of 40K characters. The modem buffer size can be dynamically set by the user program to keep the buffer space matched to the current task.

Comm-Stor IV also permits users to break large BASIC programs up into small segments for easier handling while running them as a whole, using LINK and CALL commands. The LINK command allows programs to be chained to one another in any number of combinations. The CALL function operates in a similar manner, allowing one program to call another and pass to it all of the current variables, arrays and strings.

For more information contact Albert J. Montevecchio, Sr. Vice President - Marketing, Sykes Datatronics Inc., 375 Orchard St., Rochester, NY 14606; (716) 458-8800.
Circle No. 133

RS-232 Switches

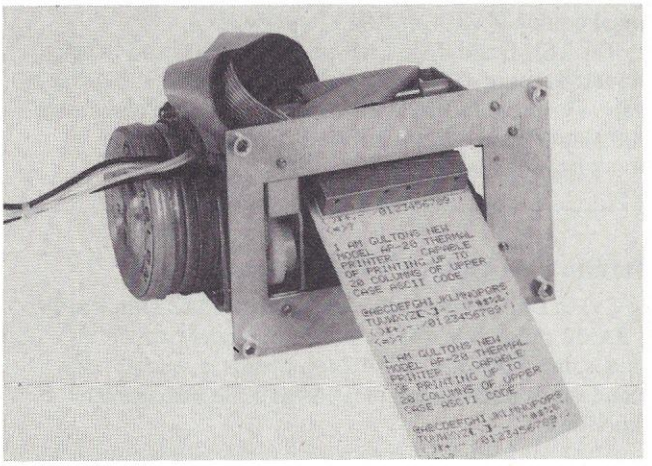
Giltronix offers a family of RS-232 switches that permit several driving devices (computers, CPUs, etc.) to be connected to a single line printer or other peripheral. By turning a switch, the user can select which device will drive the peripheral.

The RS232-X units range in price from $47.95 to $78.95. For more information, contact Giltronix, 3156 Avalon, Palo Alto, CA 94306; (415) 493-2199.
Circle No. 134

Fixed Head Thermal Printer Mechanism

The new Gulton AP-20M non-impact thermal printing mechanism can print up to 20 columns of 5 x 7 alphanumeric dot characters at 2.5 lines per second.

A fixed head design offers essentially noiseless operation and solid state switching. Only one moving part is required – the paper drive roll. The AP-20M gives the user complete independence from ink supplies and ribbon mechanisms, according to the company.



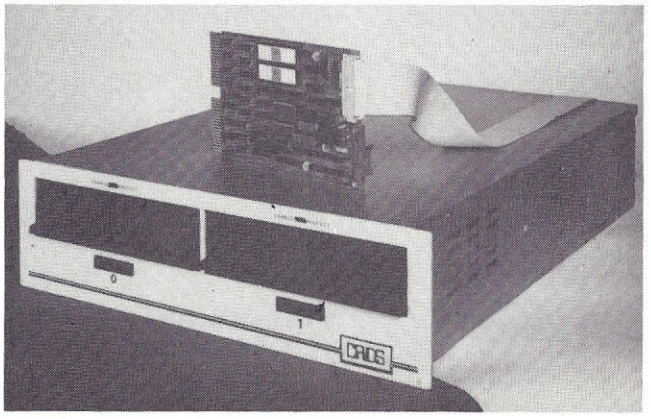
Gulton's overlapping dot head design provides sharp character definition. Reliability is rated at 20 million character lines MTBF.

Two types of mechanisms are available. One is a basic mechanism which mounts behind the user's panel. The second type contains a hinged bezel which swings the mechanism forward from the user's panel for simple paper loading, the company said. The bezel unit also contains a Power On light, a Print/Feed Switch and a paper indicator.

For more information, contact John Olobri, Measurement and Control Systems Division, Gulton Industries, Inc., East Greenwich, RI 02818; (401) 884-6800. *Circle No. 135*

Double Density Floppy Disk for LSI-11/2

Charles River Data Systems has announced the FD-211 Double Density Dual Floppy Disk System for the LSI-11. Instruction set and pin compatible with DEC's RX02 system, all controller electronics are mounted on a single, dual-height card which plugs directly into the LSI-11 or LSI-11/2 backplane.



The controller card contains bootstrap loader (eliminating need for DEC's BVD-11 bootstrap loader card), IBM 3740 formatter and interface circuitry. The FD-211 is downward compatible with all single density media and hence can be used with diskettes written for a single density and/or double density operation. Data is DMA transferred on a per-sector basis. Mounted in a 5-1/4" enclosure, the FD-211 system uses Shugart SA800 drives, designed to operate in both single and double density mode. Each drive has an LED to indicate Read or Write operation, a Write-Protect sensor and automatic head unload. Write-Protect switches are also available on the enclosure front panel. Modular construction allows for replacement of the drive, controller or power supply, thus reducing mean time to repair (MTTR), according to the company.

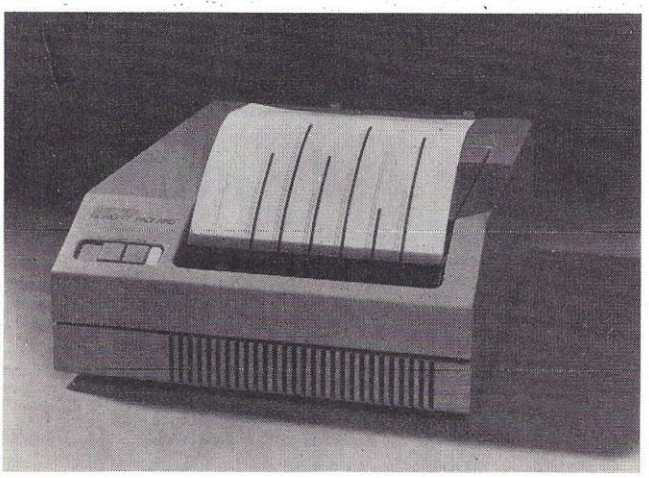
Price of the FD-211 Dual Drive Floppy System with bootstrap loader is $3250. For further information contact Charles River Data Systems, Inc., 4 Tech Circle, Natick, MA 01760; (617) 655-1800. *Circle No. 136*

Hewlett-Packard Thermal Graphics Printer

A fast, full-line (80 character) thermal graphics printer, featuring high-resolution graphics and quiet, simple operation, is available from the Hewlett-Packard Company.

The Hewlett-Packard Model 9876A prints at speeds up to 480 full lines per minute with high resolution (77 dots per inch) characters upon high contrast, fade resistant paper. It is a stand-alone version of the built-in printer of the HP System 45 Desktop Computer, and is designed for external use with HP's 9825 and new System 35 desktop

units. The 9876A was also designed for use with other computers from Hewlett-Packard and those manufactured by other companies by utilizing two interfacing modes, 8-bit parallel and IEEE-488-1975 (HP-IB).



Specific applications of the HP 9876A include high-speed listings, frequent working reports and quick plotting and graphics. Examples include environments such as laboratories and hospitals, where noise can be a problem; business situations requiring rapid production of hardcopy graphics; and remote terminal locations for data output and program development.

The full HP 9876A character set contains 128 standard ASCII characters, both upper and lower case, and control characters. Seven additional character sets of foreign languages exist in the printer at all times and can be accessed through software. Also, the user can create up to seven new characters at a time.

To perform as a stand-alone unit, the printer has a separate power supply, built-in precautions to assure that improper power levels do not damage the print head, and high-temperature protection.

The HP 9876A uses a fade-resistant black perforated paper in fan-fold configuration, which eliminates the curling characteristic of rolled thermal paper.

Top and bottom margin commands and user-controllable line spacing aid in arranging the print field upon the paper.

Two switches allow for paper movement control. One controls the paper feed motor and the other automatically advances paper to the top margin position. The printer will also stop at the end of available paper.

U.S. price of the HP 9876A Thermal Printer is $3500. Delivery time is 8 weeks. For more information contact Inquiries Manager, Hewlett-Packard Company, 1507 Page Mill Road, Palo Alto, CA 94304. *Circle No. 137*

ECD Extended Keyboard

ECD's Extended Keyboard includes 2 extra keypads with 24 keys each, all of which can be programmed by the user for special characters or control functions. ECD software provides special "parrot" functions which allow the user to assign the operation of up to 72 keystrokes to one key, including alphanumeric and/or control functions. Entire words, phrases, or control strings can thus be implemented with one keystroke.

The ECD systems also have a programmable character set which allows the user to define his own characters to match those of special print wheels, including special technical symbols and even foreign languages. Any character or key can be reassigned, or redefined, such as moving the numbers and cursor movement commands to the extra keypads. All 128 keys are relegendable, allowing the labels to be moved-or-redrawn to match the new functions.

The Extended Keyboard is a $300 option for either the ECD 7X Computer System or the Smart ASCII Intelligent Terminal. For more information contact Richard Eckhardt, ECD Corp., 196 Broadway, Cambridge, MA 02139; (617) 661-4400. *Circle No. 138*

Trainable CRT Terminal

The Series 60 "Basic Universal Terminal" has been introduced by Applied Dynamics International. PROM-programmable to meet complex protocol requirements, the Series 60 can also simulate the functions and operation of existing (and obsolete) CRT terminals from other manufacturers. It is designed to address the spectrum of CRT terminal applications from dumb to intelligent, in any quantity, with no NRE.

Series 60 incorporates two microprocessors: a Z-80 which handles the communications I/O through a UART; and a dedicated special purpose micro for display refresh. DMA transfer is available from the bus, by locking out the Z-80. The modular PROM software is both linking and relocatable.

The terminal is available in RO, KSR, ASR, multi-drop and intelligent configurations and in all screen formats from 8 x 16 to 40 x 80. Three circuit boards are used (program microprocessor, video and timing control and power supply), with provisions for three additional boards for internal memory expansion to 8K, floppy controller, and so forth.

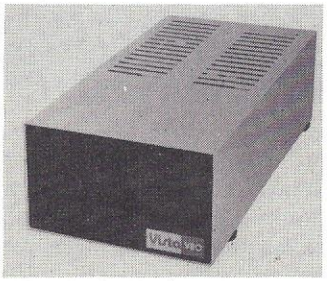
Establishing the characteristics of each customer's Series 60 configuration is accomplished by defining the program requirements on ADI's B.U.T. configurator, and burning a corresponding PROM, said the company. ASCII, Baudot, EBCDIC, Hollerith or any other desired standard or non-

standard code conversion is automatically accomplished in the process. The user's program, including all control characters, can be re-defined at any time by ordering re-defined PROMS from the factory. In many cases, ADI can burn PROMS at the user's location, via a telephone link-up.

The Series 60 is available as a complete terminal, (including keyboard and monitor), a controller only, or as board sets only. In addition, both standard and custom keyboards are separately available. Controller-only prices start at $720 for single quantities.

For more information, contact Fred Hambrecht, Communications Product Manager, Applied Dynamics International, 3800 Stone School Road, Ann Arbor, MI 48104. *Circle No. 139*

Vista Mini Disk System for TRS-80



Vista Computer Company offers the V80 Mini Disk System for the TRS-80. Included in the $395 price are a minifloppy disk, power supply, regulator and a compact case. Storage capacity of the system is 67,800 bytes.

A connecting cable is available at $29.95. For more information contact George McMurtry, President, Vista Computer Company, Dept. P3, 2909 Oregon Court, Torrance, CA 90503; (213) 320-3880. *Circle No. 140*

TRS-80 Voice Synthesizer

An electronic voice response synthesizer, designed specifically for Radio Shack's TRS-80 home computer, is being introduced by the Votrax Division of Federal Screw Works. Through the peripheral voice module, which comes in the form of a plug-in box, TRS-80 users will be able to program their computer to actually talk back to them.

The Votrax synthesizer converts the computer's output into electronically synthesized speech with an unlimited vocabulary. This conversion is accomplished by producing words and phrases utilizing phonemes (the basic sounds of spoken language). By integrating phonemes, the system creates smooth, intelligible speech, the company said.

The voice synthesizer unit will interface with the Level I computer without any modifications.

Included with the unit is a Black Jack program that makes card shuffling sounds, asks for your bets, verbally prompts you on your turn and makes humorous comments about your bets, winnings and losings. Other applications

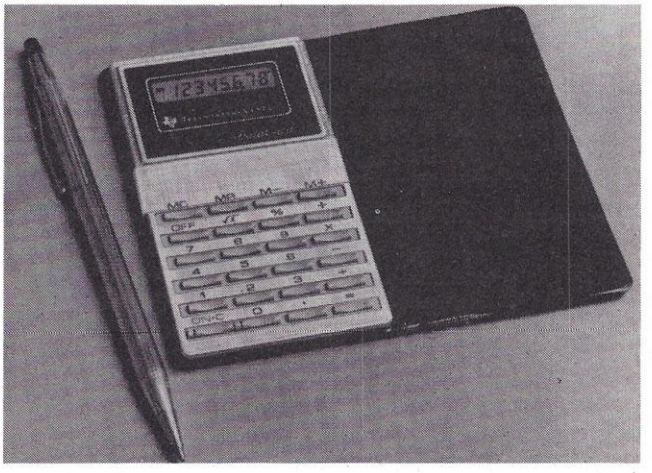
include games, computer-aided instruction, clocks and alarm systems.

For more information contact Hy Siegler, Publicity, Radio Shack, 1400 One Tandy Center, Ft. Worth, TX 7610 76102; (817) 390-3272. *Circle No. 141*

COMPLEMENTS

Pocket Calculator With Memory from TI

TI's smallest calculator, the slimline DataCard features a large, easy-to-read, LCD (Liquid Crystal Display) readout and the six standard functions of add, subtract, multiply,



divide, percent and square root. The unit has four key memory (MC, MR, M+, M-), measures 170 inches by 2.25 inches by 3.75 inches and weighs less than 2 ounces.

Two miniature silver oxide batteries provide up to 1500 hours of operation. Battery life is enhanced by the APD automatic power down feature which turns off the calculator after two to six minutes of non-use. Battery condition is indicated by a small caret symbol in the upper right-hand corner of the display when the unit is in use.

DataCard's suggested retail price is $30. For more information contact Texas Instruments Incorporated, Consumer Relations, P. O. Box 53 (Attn: DataCard), Lubbock, TX 79408; (214) 238-2011. *Circle No. 142*

Programmable Tennis Machine

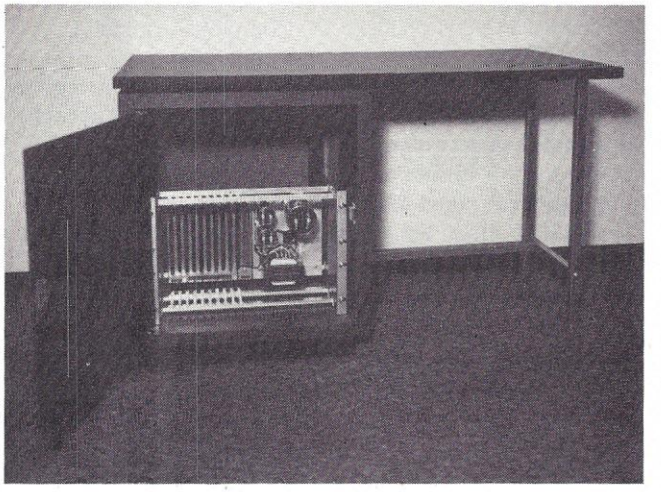
United States Machine Works, Inc., has developed The System, a computer programmable ball machine for tennis.

The System serves from an overhead position. You practice returning serves and overhead smashes against gamelike shots. With the wireless six-function remote control, you can operate the System from anywhere on the court. The automatic self-programming keys allow you to match skills against a program written by The System for singles or doubles.

For more information contact United States Machine Works, Inc., 21 Williams Place, Lansdale, PA 19446; (215) 855-4000. *Circle No. 198*

Desk and CPU Cabinet

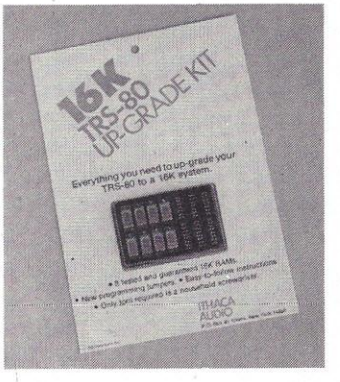
A desk and CPU cabinet from Group Two offers a work station for your computer system. The black laminant top



is available either in 24" x 48" or 32" x 60". Twenty-six-inch chrome legs with cross brace and adjustable levelers attach to the CPU cabinet. Included in the cabinet is a bronze plexiglass door with chrome hardware and magnetic lock and a removable back panel. Adjustable shelves are optional. Dimensions are 23"w x 26"h x 23 1/2"d or 23"w x 26"h x 32"d.

For more information contact Group Two, 4901 Morena Blvd., Suite #305, San Diego, CA 92117; (714) 270-6201. *Circle No. 143*

Upgrade Kit for TRS-80



Ithaca Audio has released a kit for upgrading the Radio Shack TRS-80 Microcomputer System to 16K RAM. The Ithaca Audio 16K TRS-80 Upgrade Kit comes with preprogrammed jumper shunts for both Level I and Level II machines and eight fully-tested 16K dynamic RAMs. These are plugged into the keyboard or expansion module of the TRS-80.

Suggested retail price for the kit is $140. For more information contact Mary Ann Reeter, Marketing Manager, Ithaca Audio, P. O. Box 91, Ithaca, NY 14850; (607) 273-3271. *Circle No. 144*

Cassette Program Storage Albums

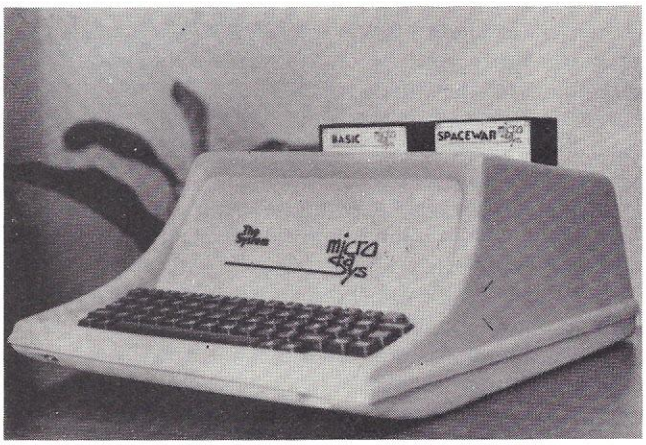
Reliance manufactures durable heat sealed vinyl albums to help you organize your cassettes with program documen-

tation and notes for safe, convenient storage. Snap-in cassette compartments maintain firm hold on cassettes but allow easy fingertip removal. Hub rotation is prevented. Some models have patented dust-tight snap-lock closure.

For a complete catalog contact Reliance, Plastics and Packaging Division, 108-18 Queens Blvd., Forest Hills, NY 11375; (212) 544-0800. *Circle No. 145*

Keyboard Unit from MicroDaSys

MicroDaSys' Enclosure/Mainframe/Keyboard unit is small and lightweight and includes a full sized ASCII encoded keyboard including alpha lock, cursor control and two user defineable keys. The keyboard generates all 128 ASCII codes.



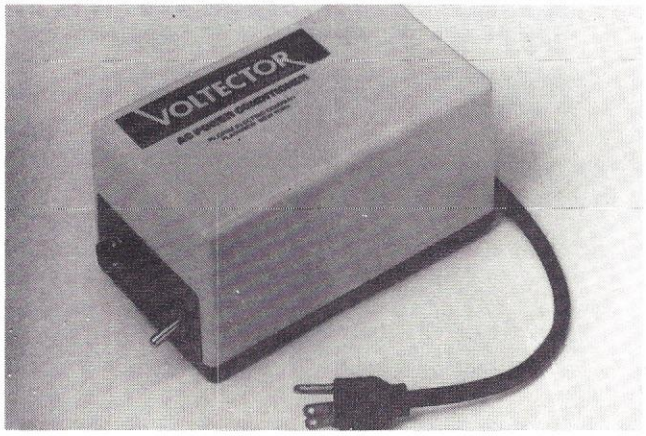
Inside is a 16 amp power supply with enough drive for a full set of S-100 cards and 2 floppy disk drives. The S-100 bus motherboard of the unit can accomodate any of the hundreds of boards now available for this bus, such as video/graphics boards, processors, music boards, speech boards or I/O cards, said the company.

Price is $249 (kit) or $299 (assembled). For further information, contact MicroDaSys, P. O. Box 36051, Los Angeles, CA 90036; (213) 935-4555. *Circle No. 146*

AC Power Conditioners Protect Sensitive Equipment

Three new low cost VOLTECTOR Series 5 AC Power Conditioners protect Micro/Minicomputers, Point-of-Sale Terminals, Word Processing Equipment and other sensitive electronic devices from over 99% of the destructive surges, spikes and high energy transients that are often present on a building's primary power line, according to Pilgrim Electric Company.

These power conditioners limit 2500 volt spikes to safe levels. They will handle 60 Joules of transient energy, and provide both common and transverse mode protection against pulsed, continuous and intermittent power line noise, said the company. Insertion loss is 70 dB above 0.5 MHz. They are internally fused, and rated 120, 240, and 360 VA at 120 Volts. The units are equipped with an on/



off switch and a pilot light, and are designed for office use.

Prices range from $142 to $156 per conditioner. For more information contact Pilgrim Electric Co., 29 Cain Dr., Plainview, NY 11803; John Alden at (516) 420-8989. *Circle No. 147*

Studio II Conversion Kit

ARESCO has made available information and components to convert the RCA Studio II video game into a simple microcomputer. The information package describes how to construct a new cartridge for the Studio II, includes schematics, ROM monitor listing, operating instructions and program listings and is available for $5. ARESCO also offers a printed circuit board and pre-programmed PROM containing the conversion program, as well as a fully assembled and tested cartridge. No modifications to the Studio II are required.

With the new cartridge, the user can enter machine language programs through the Studio II keypads, and the programs can be controlled from the keypads and generate TV displays on a standard TV attached to the Studio II. The converted Studio II contains 512 bytes of RAM, 256 bytes of ROM, an RCA COSMAC 1802 microprocessor, a video graphics interface, an FCC-approved RF modulator, two ten-key keypads and a processor controlled beeper.

For more information contact ARESCO, P. O. Box 43, Audubon, PA 19407; Rick Simpson, (215) 631-9052 or (215) 631-9257. *Circle No. 148*

Pure Copper Desoldering Braid

Solder Removal Company has introduced its desoldering braid, Soder-Wick, in six width sizes. Each size is packaged in a five-foot roll dispenser suited for preventive and routine desoldering maintenance on any size printed circuit board, terminals, lugs, wires and all solder connections, said the company.

Soder-Wick's pure copper braid is protected by a non-activated, pure water white rosin flux which prevents oxidation. Soder-Wick's purity affords maximum absorption and assures clean and contaminant free desoldering. Absorption of the solder into the braid can be seen as the solder is pulled from the component lead by capillary action. Overheating of the component lead is therefore eliminated.

For more information contact Solder Removal Company, 1077 E. Edna Place, Covina, CA 91724; (213) 967-3681. *Circle No. 149*

Vowel Power Module for Speak & Spell

The Vowel Power module, the first in a series of plug-in word modules expanding the capabilities of the Speak & Spell learning aid, has been introduced by Texas Instruments.

The module expands the built-in vocabulary of Speak & Spell, and all Speak & Spell activities can be played with the module's vocabulary. In addition, the book included with the module is filled with games and activities designed to involve the child in enjoyable, educational experiences with vowel sounds and patterns, TI said.

The Vowel Power module offers the child an aid for mastering vowel sounds. The module contains 140 words, divided into four categories: Level A, short vowel sounds; Level B, long vowel sounds; Level C, 2-letter or digraphic vowel sounds; and Level D, vowel-R sounds. By hearing, spelling and reading these words, a child can become familiar with the patterns that vowel sounds follow in the English language.

Retail price of this module is $15. For more information contact Texas Instruments Incorporated, Consumer Relations, P. O. Box 53, Lubbock, TX 79408, (214) 238-2011. *Circle No. 150*

Custom Carrying Case for the TRS-80

A matched set of custom-built cases to carry, protect and store the Radio Shack TRS-80 computer is now available

from Ambico Inc.

Each carrying case is made of durable vinyl and has a black textured finish and a luggage style handle. The cases

are dustproof and have bottom skids for added protection. The "A" case holds the computer's 12-in. video monitor, while case "B" accommodates the computer keyboard, cassettes and accessories.

Suggested retail prices are $35 for case "A" alone and $25 for case "B" alone. For further information contact Steve Bender, Ambico Inc., 101 Horton Avenue, Lynbrook, NY 11563, (516) 887-3434. *Circle No. 151*

Static Control Floor Mats

Damage to computer equipment caused by operator-generated static electricity can now be eliminated with new colored floor mats from 3M Company's Static Control Systems Department.

Placed in front of electronic equipment, the Static Control Floor Mats, Type 9100, drain static from the bodies of people before they contact the equipment. This eliminates problems of data loss, program change and uncontrolled printer output. It can also protect the operator from static shocks.

The mats are composed of four layers. The top layer is conductive and does not depend on humidity and other environmental factors to function satisfactorily. The second layer is a highly conductive reinforcing fabric which provides the main discharge path through the mat to a ground cord terminal. Once this cord grounds the mat, it cannot "fill up" with static charge and fail to perform. An anti-skid backing keeps the mat in place.

The mats are available in chocolate brown, autumn gold and forest green. They can be cleaned with water and detergent and are flexible, conforming easily to any supporting surface.

For more information, write Department SC8-25, 3M Company, P.O. Box 33600, 3M Center, St. Paul, MN 55133; (612) 733-4339. *Circle No. 152*

SOFTWARE

Program Tapes from Hayden

Hayden Book Company, a leader in personal computing book publishing, now publishes computer program tapes as well. Their initial offerings include:

*Game playing with BASIC – 27 games on three tapes, at $9.95 per tape, for PET, TRS-80 Levels I and II, and Apple II.

*The First Book of KIM – 28 recreational programs and 13 utility programs on three cassettes, at $9.95 per cassette, for KIM.

*How to Build a Computer-Controlled Robot – one $14.95 cassette featuring five control programs for a computerized robot, for KIM.

*Sargon: A Computer Chess Program – one $19.95 cassette for TRS-80 Level II featuring the program that won the 1978 West Coast Computer Faire Chess Tournament.

Forthcoming tapes for PET, TRS-80 Levels I and II and Apple II include General Math, Complex and Matrix Math and Introductory Engineering Math, each for $9.95.

For more information contact Hayden Book Company, Inc., 50 Essex St., Rochelle Park, NJ 07662. *Circle No. 153*

Work-In-Process System

The Work-In-Process System from F.N. Kautzmann & Associates was written on a modular basis for ease of modification and includes A/R, A/P, G/L and P/R. All applications in the package may interface automatically with G/L. G/L comes equipped to handle multi-company, division and department. The package can maintain budgeting and assets and password security is also provided. A/R functions as either a balance forward or open items system. Charge processing includes payment penalties, interest and discounting. Multi-company and multi-division processing is accomodated.

A/P is a voucher based distribution and check writing system. Fixed payments such as rent may be a one time entry. A/P provides for projected cash requirements, payment selection, aging by vendor, vendor analysis and handwritten checks. P/R allows for four pay cycles – weekly, bi-weekly, semi-monthly and monthly. Bonuses, commissions, vacation and sick pay are accomodated along with salary regular and overtime earnings. There is provision for up to seven voluntary deductions – limit, bond type, one time, fixed amount and percentage.

For information contact F.N. Kautzmann & Associates Inc., 2203 Briarview, Suite 104, Houston, TX 77077; (713) 493-1721. *Circle No. 154*

Business Software For Micropolis MOD II Floppy Disk System

Structured Systems Group now offers its line of microcomputer business applications software on the Micropolis Mod II format 5-1/4" diskette. SSG's software line, which will continue to be available on 8" disks, includes:

General Ledger: A comprehensive applications package suitable for multi-client public accounting, or for multi-corporate or multi-profit-center accounting for corporations, partnerships or proprietorships.

Accounts Receivable: A system that produces customer statements and aged schedules of account. The package will operate alone, or interface with the G/L. Other features include reminder notices, sales reports, balance forward or open item accounting, and a 25,000 customer capacity.

Accounts Payable: Designed to produce aged statements of account and to write checks in payment of desired invoices. The package will interact with the G/L or stand alone.

NAD: A name and address file that allows the user to produce mailing lists according to user-defined parameters.

QSORT: A full-disk sort/merge program for organizing computerized files.

CBASIC-2: business-oriented BASIC language specifically designed for the CP/M operating system.

The software runs on 8080 based and Z-80 based microcomputers with a minimum 48K RAM memory and dual disks operating under CP/M.

Structured Systems Software is available through computer retailers or directly from Structured Systems.

For more information, contact David Carlick, Marketing Director, Structured Systems Group, Inc., 5208 Claremont Ave., Oakland, CA 94614; (415) 547-1567. *Circle No. 155*

Compucolor Othello

The board game Othello can now be played on the Compucolor II computer. Compucolor Corporation has created a microcomputer version of the game, and CBS Toys, owner of the Othello board game, has given Compucolor a license to produce and market the computer version.

Othello blends the elements of luck, skill, patience and logic. The computer can play against a single opponent. Or, if two players wish to play one another, the Compucolor II will act as a referee, accurately recording the scoring and disallowing illegal moves. For more information, contact Joy Baker, Marketing Representative, Compucolor Corporation, P.O. Box 569, Norcross, GA 30071; (404) 449-5879. *Circle No. 156*

Data Base Management System

A data base management system (DBMS) from Micro-Ap allows users of CP/M based microcomputers to enter records and update files interactively and provides full query and report writer functions, according to a company spokesman.

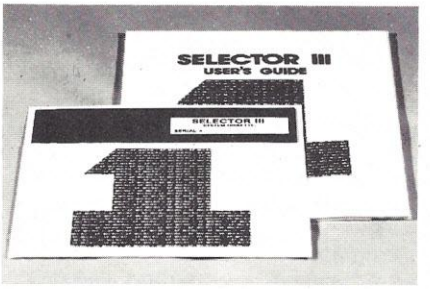
The system is distributed with a library of predefined record formats in a data dictionary, and programs to manage and report sales activity, inventory, payables, receivables, check

resister, expenses, appointments and name and address functions.

The system supports up to 24 items (fields) per record. Any or all fields may be designated as Keys for retrieval purposes. This allows records to be recalled, for instance, by name, date, dollar value, part number or any other field value. Partial and duplicate keys are allowed and may be changed on line.

Once a record is retrieved, the file may be browsed in ascending or descending sequence by the wanted key. Reports may be generated in the same way and contain control break and grand numeric summaries of totals, averages, maxims or minima.

Selector III is distributed on diskette with source code (except for a machine language key maintenance program). User's system requirements are 48K, CP/M (or derivative), 2-mini single density drives or 1 larger capacity drive, terminal or monitor with up-cursor and erase screen codes,



and ideally, a printing device. It operates under CBASIC (also distributed by the company), and costs $295. CBASIC – which provides chaining with parameter passing and complete commercial BASIC functions costs $49.95 with Selector, or $89.95 separately. Contact Micro-Ap, 9807 Davona Drive, San Ramon, CA 94583; (415) 828-6697. *Circle No. 157*

High-Speed Sort Program

A new high-speed sort program for the Tektronix 4051/4907 File Manager, called QSM1, the Intelligent Sort, has been introduced by Leland C. Sheppard.

Using a combination of internal quicksorts and internal/external merges, QSM1 offers a 30% to 75% improvement in run time, compared to existing sort programs for the 4907, according to a company spokesman.

QSM1 is a stand-alone program (it does not run as a subroutine). QSM1 automatically reprograms itself to handle different file formats, thus eliminating the need to reprogram a subroutine to handle each different file. QSM1 has the capacity to handle 50,000 record single-volume random files.

The Intelligent Sort also offers an automatic phase restart capability, to minimize rerun time due to disk errors, power failures, etc., optimization of work and output file placement for increased throughput and dynamic optimization of the merging technique to minimize run time.

Also announced are a 4907 version of the popular development and debugging aid, Documenter-II, and a 4907 command interface utility call $DEBE. Documenter-II provides a compiler-type listing of 4051 BASIC programs including a formatted listing of the program, variable cross-reference and statement number cross-reference. $DEBE will execute 25 4907 commands through the 4051 function keys. The user is prompted for all information required to execute each command.

Pricing for QSM1 and Documenter-II start at $300 for a single copy; $DEBE pricing starts at $100. Prices for all products include program source and documentation on a cartridge tape, user instructions and one year of maintenance. For more information contact Leland C. Sheppard, Dept. P, P.O. Box 60051, Sunnyvale, CA 94086; (408) 733-8651.
Circle No. 158

Software from Binary Systems

Binary Systems, Inc., is now offering BASIC software source listings, along with programming language and user's manuals and the complete source listing of Disk BASIC Etc, an interpreter.

Immediately available are source listings and manuals for CPA (Computer Prepared Accounting), a general ledger system and Write-On, an automatic letter-writing system.

The CPA source listing consists of 2000 lines of code. Routines include ISAM (Indexed Sequential Access Method), a sort segment and routines for chaining trailers, both forward and backward.

The Write-On source listing consists of 700 lines of code. In addition to utilities, the listing includes segments of string manipulation coding illustrating the use of string operators and functions.

Both CPA and Write-On work with an iCOM company model FD3712 dual-drive floppy disk storage device and a Diablo or dot-matrix printer. The user must adapt the software to systems with other components. The programs and work space of each system require at least 32K bytes of RAM. Both the CPA source listing and the Write-On source listing sell for $75 each.

Purchasers of Disk BASIC Etc receive a 48-page language manual and a 50-page instruction manual for modifying or adding routines. The 6000-line source listing, together with the two manuals, equip owners of Z-80 and 8080-based machines with the tools for a comprehensive BASIC interpreter that may include user-defined command and I/O routines, said the company.

Disk BASIC Etc provides integer functions (ASCII, POS (ition), SEARCH, USR, etc.), and a full complement of floating-point math functions, such as ATAN, FLT, SIN and VAL. The program generates 32 error

message codes and features flexible editing capability. Direct memory and I/O addressing is standard. Price for the source listing and the two manuals is $100.

For more information contact Micro Store, 634 S. Central Expressway, Richardson, TX 75080.

Circle No. 159

Video Checkers on Cassette for TRS-80 and PET

Compu-Quote has converted their Video Checkers to run on the TRS-80 and the Commodore PET. The two new cassette versions each produce complete checkerboard graphics.

The game is played using International Rules. As the player and the computer take turns, the checkers blink and move to indicate their passage. Kinged pieces are identified on the display and messages appear at the right of the board relating to each

move. In accordance with International Rules of the game, the program will not accept illegal moves and warns of their entry.

The PET version will play on an 8K machine while the TRS-80 version requires Level II BASIC and 16K. Complete operating instructions are included with each redundantly recorded cassette. Video Checkers costs $14.95. Contact Compu-Quote, 6914 Berquist Ave., Canoga Park, CA 91307.

Circle No. 161

Accounting System for Ohio Scientific

OS-AMCAP, a fully integrated small business accounting system, runs on any Ohio Scientific dual-floppy, quad-floppy or hard disk based 6502 system. The package contains the following integrated modules:

- General Ledger, including a complete chart of accounts, cash receipts, cash receipts journal, cash disbursements, cash disbursements journal, adjusting journal entries, chart of accounts, editing, beginning balance, trial balance and statement of earnings.
- Accounts Receivable with aging.
- Accounts payable with aging.
- Inventory, including inventory analysis, inventory by vendor, inventory overdue, inventory on order, inventory re-order and detailed reports.
- Billing/Invoicing for the inventory which will optionally support Customer Files with bill to, ship to,

credit and customer mailing Monthly Statements.

• Payroll.

The AMCAP system includes a configuration program which automatically creates all necessary disk files based on the user's requirements for inventory items, accounts receivable entries, accounts payable entries, chart of accounts and other company information. A demonstration disk, preloaded with information for a hypothetical company, is also available for demonstration and training purposes.

OS-AMCAP is designated by Ohio Scientific as a small, "turnkey" business software package. It is not designed for end user modifications or customizations. Retail price is $975. For more information contact Ohio Scientific, 1333 S. Chillicothe Rd., Aurora, OH 44202; (216) 562-3101. *Circle No. 162*

FORTRAN for TRS-80

A FORTRAN and assembly language software package for Radio Shack's TRS-80 microcomputer is now available from Microsoft, who wrote TRS-80 Level II BASIC. The package includes Microsoft's FORTRAN-80 compiler, macro assembler, text editor and linking loader.

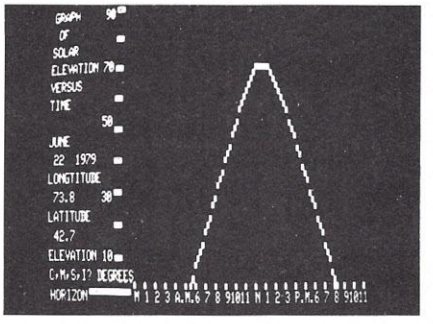
Compatible with FORTRANs used in business and engineering, Microsoft's FORTRAN package provides assembly language development tools for TRS-80 disk systems. The editor allows creation of assembler source files, data files and FORTRAN files.

The Z-80 macro assembler has a complete macro facility, full set of conditional and relocation pseudo operations. The text editor provides fast random access editing capabilities, using straightforward, easy-to-understand commands, Microsoft said. FORTRAN-80 includes all of ANSI 1966 FORTRAN (except the COMPLEX data type), plus enhancements such as mixed mode arithmetic, logical operations on integer data, ENCODE/DECODE for format operations to memory, and end-of-file and error-condition trapping for read and write operations.

The TRS-80 FORTRAN package is fully compatible with TRSDOS. It is supplied on two minidiskettes and requires a minimum 32K TRS-80 disk system. The entire package – FORTRAN compiler, runtime library, macro assembler, text editor and linking loader – costs $350. For more information, contact Steve Wood, General Manager, Microsoft, 10800 NE Eighth, Suite 819, Bellevue, WA 98004; (206) 455-8080. *Circle No. 163*

Program Calculates Sun's Position

The sun's local elevation and azimuth can be calculated at any loca-



tion on earth using the Sungraph program. Options include graphs of elevation vs. time of day, azimuth vs. time of day, maximum elevation vs. date and elevation at a specified azimuth vs. date. Save option allows a graph to be stored on cassette and reloaded at a later time.

Written in TRS-80 Level II BASIC the program requires 13K bytes of storage. It's available on cassette for $49 or diskette for $75 (quantity discount prices on request). For more information contact Solartek, P.O. Box 298, Guilderland, NY 12084. *Circle No. 164*

Mailing List System

MAIL-III, a comprehensive mailing list system under Radio Shack's TRS-80 system, consists of two programs. The first program lets you enter, display, search, update and delete name and address information. It also initializes the mailing list and displays system information, such as the maximum number of records allowed and number of records used.

The second program produces labels sorted in name, city, state or zip code order. Labels can be printed on the printer or displayed on the screen. A two-digit "select" code is used to identify an input session or to classify the people in your mailing list, such as doctors, commercial accounts, paid members, etc. You may select to print those labels that belong to a certain code or a specified range of codes. For example, you can produce all the labels entered today. You can put 500 names in a diskette, or more if you have another drive or use the diskette only for data file. For unlimited number of names, spread your mailing list in more than one diskette. Diskette and 16K are required. Price is $35. A simplified cassette version requires 16K and Level II BASIC, and is sold for $19. For more information contact Micro Architect, 96 Dothan St., Arlington, MA. 02174. *Circle No. 165*

North Star Word Processor

IDSWORD is now available in North Star Basic Version 6 under North Star DOS Resease 4.0. The comprehensive word processing package, originally developed for the Altair by Interactive Data Systems Inc., has been converted by CW Applications, an affiliate of The Computer Workshop.

With IDSWORD, prompts are given as complete English sentences and responses are accepted as words, rather than numbers. The intent was to avoid artificiality, said the company. Imbedded commands are not required, since IDSWORD formats the text interactively. Features include: insertion, deletion and block moves of text; global searches; complete text editing on CRT or printer; variable speed scrolling of text; page numbering and titling (top or bottom); reformatting data for maximum line size; control of margin size and justification; processing of non-IDSWORD files; merging of up to ten files; form letter printing with justification and text insertion from up to twenty mailing list files; and sorting and printing of mailing labels.

Block editing capability on the CRT is available without the expense of a video interface, by means of a linked-list of all lines of text in mem-

ory, coupled with full cursor control over the entire text display. The amount of text in memory is automatically adjusted to the available memory. A 64K system holds more than a page of text in memory. About twenty-five pages of text may be stored on a single density diskette. Longer documents may be developed and printed in segments.

IDSWORD will run with one or two disk units and is presently configured to run with the Soroc, ADM3A, Hazeltine and Intertube terminals, and the IBM Selectric, Qume, Diablo and Spinwriter printers. Specify your configuration when ordering.

IDSWORD is a modular system starting at $125 for the basic configuration. The complete word processor is priced at $245 for the CRT edit capability or $220 for the editing on the printer capability. Add $50 for the form letter, labels and name and address file maintenance and sort modules. Automatic upgrades are provided for one year for an additional $25, or two years for $40. The diskettes are included in this price. Enhancements, such as proportional spacing, tabbing and sorting, will be available shortly.

For more information contact CW Applications, 1776 E. Jefferson St., Rockville, MD 20852; (301) 468-0455. *Circle No. 166*

Documentation/Specification Generation System

EFAX Corporation recently released DOCGEN, an on-line documentation/specification generation system designed to facilitate creation of standardized 8½" x 11" documents.

DOCGEN, a system of DATABUS programs that executes under DATASHARE, prompts the user to enter comprehensive system and program information to create a document containing five different modules including overview narrative, equipment configuration, system and program flow diagrams, program user's guides and file/record definitions. DOCGEN is a front-end to Datapoint's word processing utilities, DSCRIBE and MSCRIBE, which require special control characters to be entered along with the text to produce the desired output format. DOCGEN automatically embeds these special control characters as the information is entered, thereby generating completely formatted documents.

Although processing of the DOCGEN output files by DSCRIBE and MSCRIBE must take place under DOS, all printing is performed under DATASHARE using print files via the DOCGEN print control supervisor.

Distributed in DATABUS object form, the package is available for $1750 under a permanent license agreement from EFAX Corp., 880 North York Rd., Suite 202, Elmhurst, IL 60126.

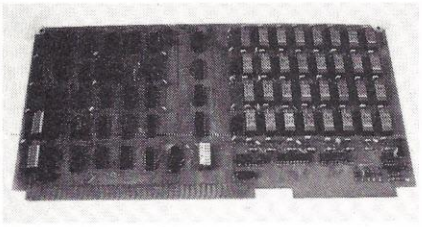
Circle No. 167

P.C. BOARDS

Memory Module from Chrislin

Designed specifically for Intel's intellec MDS 800, SBC 80/10, SDK-86 and BLC 80/10 microcomputers is Chrislin Industries' newest CI-8080 memory module. The new memory features expansion to 32K, 48K or 64K bytes on a single board. The memory is compatible with both 8 bit and 16 bit multibus based systems. The CI-8080 is designed to plug directly into the memory slot of the MDS 800 and the SBC 80/10.

The CI-8080 allows maximum processor throughput with the use of on board refresh control logic. Data access time is 270 nsec and cycle time is



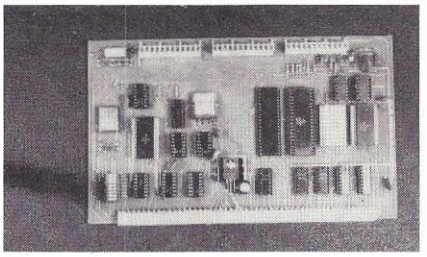
400 nsec. Memory is addressable in 4K increments up to 64K words of memory. It is available with battery backup capability. The CI-8080 size is 6.75" x 12", while power consumption is under 7 watts. Single quantity price is $390 for 16K x 8 and $890 for 64K x 8.

For more information contact Chrislin Industries Inc., 31352 Via Colinas, #102, Westlake Village, CA 91361; (213) 991-2254. *Circle No. 178*

SS-50 Bus Compatible Central Processor Board

The CPU-2 is an SS-50 bus compatible central processor board that uses the Motorola MC6802 Microprocessor IC, MC6850 ACIA, MC14411 Baud Rate Generator, and a MOS Technology MPS6532 Memory-I/O-Timer array. The board uses separate crystals for the baud rate generator and the 6802, has power-on reset, switch selectable baud rates, RS232 and current loop serial port, and two 8-bit parallel I/O ports. There is a 128 byte RAM at $F400 through $F47F for the stack and registers. Also a 128 byte RAM at $0000 through $007F that can be used in small systems or disabled when external RAM at the same locations is used.

Provision is made for an on-board 2708 or 2716 EPROM to give 1K or 2K of ROM to contain an operating program or a monitor program. This



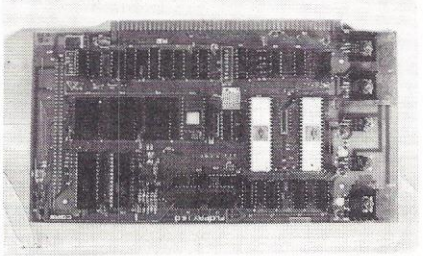
board can be used by itself in small measurement and control applications requiring up to 16 parallel I/O lines and 1 serial port. The board can also be used in a fully expanded SS-50 bus system where it can address up to 62K of external RAM (3K is reserved for on board uses).

A preprogrammed monitor EPROM (FADBUG) is available. It supports the serial port, an ASCII Keyboard, and a 32 or 64 character by 16 line TV display using a VDB-1 Video Display Board. It provides memory functions, interrupt and breakpoint handling and load and dump routines to a cassette or terminal.

For more information contact F & D Associates, 1210 Todd Rd., New Plymouth, OH 45654. *Circle No. 179*

Single I/O Card for S-100 Bus

A single I/O card for the S-100 bus from Trace Electronics contains four programmable parallel ports, two duplex serial ports, baud rate generator, two 16 bit programmable interval timers, room for up to 16K of EPROM (2708, 2716, 2732) and a connector to adapt the Persci 1070 intelligent floppy disk controller to the S-100 bus.



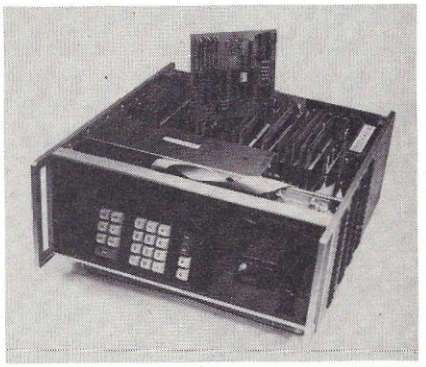
This single card can interface CRT terminals, keyboards, printers, paper tape readers, EPROM programmers, up to four floppy disk drives (with controller) and still provide EPROM space and two 16-bit timers.

The floppy I/O card is compatible with Altair 8800, Imsai 8080 and the CGRS 6502/S-100 MPU. The card is available in kit form for $169.95 and assembled for $219.95. For more information contact Trace Electronics, Inc., 510 West DeKalb Pike, King of Prussia, PA 19406; (215) 265-9220. *Circle No. 180*

Interface Links MCSIM to Host Computer

A paper tape emulating interface for linking a microprocessor development station to any host computer has been introduced by Analytyx Electronic Systems, Inc.

The Analytyx A10000 MCSIM Link is an RS-232C interface that allows direct connection between any host computer and a Scientific Micro Systems (SMS) MCSIM microprocessor development station for the Signetics 8X300. Used instead of the MCSIM paper tape reader, the unit eliminates paper tape errors and tape



punch hardware, the company said. At the user's option, reflected data is provided for software verification. Load rate is 110 cps; RS-232C rate is 9600 baud.

Incorporating the same data/control format as the MCSIM paper tape reader, the interface allows use of existing computer software by changing the output driver from paper tape punch to RS-232C interface. For PDP-11/RT-11 users, the firm offers the A100010 software package to link and

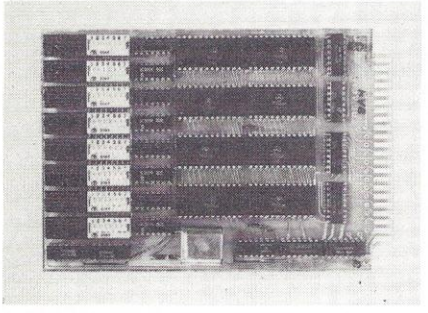
WHAT'S COMING UP

load an optimized SMS Cross Assembler (MCCAP) with MCSIM and PROM Programmer.

Price is $970 for single units. A10010 software sells for $500 per facility. Literature is available on request. For more information contact Analytyx Electronics Systems, Inc., Robert R. Jehu, Vice President, 106 Daniel Webster Highway, South Nashua, NH 03060; (603) 888-5400. *Circle No. 181*

Microcomputer Serial I/O Module

Eight RS-232C asynchronous serial I/O ports on a 4½" x 6½" industry standard module with 22/44 pin edge connector are available from Wintek



Corp. Each port supports all standard baud rates from 150 to 9600. Baud rates are crystal controlled and individually switch selectable. Applications include data concentrators, key-to-disk systems and communications switches. The serial I/O Module can be supplied with 2, 4, 6 or 8 ports with unit prices of $99, $149, $199 and $249, respectively. Contact Wintek Corp., 902 N. 9th St., Lafayette, IN 47904; (317) 742-6802. *Circle No. 182*

Answers to Computer Languages Quiz

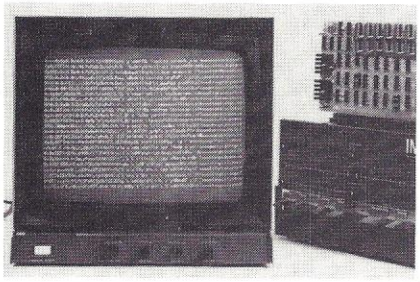
1. c	12. true	24. true
2. c	13. b	25. b
3. c	14. d	26. b
4. d	15. a	27. b
5. d	16. b	28. d
6. subscripted variable	17. true	29. b
	18. d	30. a
7. c	19. a	31. d
8. d	20. b	32. a
9. b	21. COBOL	33. c
10. b	22. b	34. a
11. c	23. true	35. a

ALTR-2480 Video Display Board with Transparent Memory

Matrox Electronic Systems has developed the ALTR-2480, a new 24 line x 80 character alphanumeric video interface card for the S100 bus.

According to the company, the unit incorporates Transparent Memory, a method of solving the classic memory contention problem common to all CRT displays. The problem occurs because the display refresh memory must be accessible by both the CRT controller for CRT refresh and by the CPU.

Up until now, Matrox said, this problem has been "solved" by two basic methods. The first method, commonly known as the video RAM approach, allows the refresh memory to be switched between the CRT controller and the CPU by means of data multiplexers and three state buffers. The problem with this method is that CPU accesses disconnect the refresh memory from the CRT controller. These accesses are then visible as annoying streaks or glitches on the screen. The interference can be eliminated by confining VRAM accesses to



the horizontal or vertical retrace interval. This later solution restricts the speed of CRT screen updates.

The other common solution to the memory contention problem is the DMA (direct memory access) approach. The display refresh memory is part of the CPU's main memory. The CRT controller forces the CPU to halt wherever it requires access to the memory. This method slows down the CPU and adversely affects system timing since the CRT must be refreshed constantly.

Matrox's transparent memory design eliminates all of these problems, the company said. The CPU can access the refresh memory at any time, the display is completely glitch free and the CPU is never interrupted. The method is general and does not rely on the timing characteristics of a particular CPU. This feature permits its use with most micro and minicomputers. The transparent memory design utilizes a clever multiplexing technique which permits non-conflicting access by both the CRT controller and CPU.

Single quantity price is $295. For more information contact Matrox Electronic Systems, Ltd., 2795 Bates Rd., Montreal, Que., H3S 1B5, Canada; (514) 481-6838. *Circle No. 183*

Micro Networks' Analog Input/Output Board

A new analog I/O board from Micro Networks Corporation offers 19 bits of dynamic range and interfaces electrically and mechanically with SBC-80/10, 80/20 and 80/30 microcomputers.

The standard MN7300 provides 16 input channels. The optional multiplexer expander increases the number of input channels to 32 single-ended or 16 differential. Two output channels with either voltage or 4 to 20 mA outputs are also available.

The 12 bit A/D and 8 level programmable-gain amplifier provide 19 dB as dynamic range. The gain of this amplifier is software controlled, allowing the user to program different gains for different channels or to autorange on a given channel. Using the programmable-gain amplifier, the basic user-selectable input ranges of 0 to +5 V, 0 to +10 V, ±2.5 V, ±5 V and ±10 V can be modified under software control by gains of 1, 2, 4, 8, 16, 32, 64 and 128. This allows full scale input ranges from ±19.5 mV to ±10 V, solving the common data acquisition problem of having to cope with a variety of transducers whose outputs range from millivolts to volts and with signals having a wide dynamic range, the company said.

The two optional output channels can be used for driving CRT displays, pen plotters and other analog control applications as well as for generating complex analog waveforms. Both channels can be configured for voltage outputs of 0 to +5 V, 0 to +10 V, ±2.5 V and ±10 V; or for 4 to 20 mA current outputs.

Memory mapped for flexibility, the MN7300 occupies 10 consecutive locations that may be positioned as a block anywhere in user memory. All activities of the card are completely controlled by software; sample programs for controlling MN7300 operation as well as functional explanations and circuit diagrams are included in the applications manual that accompanies each MN7300.

Price is from $612 to $1138, depending upon options selected. Delivery is stock to four weeks ARO. Contact Micro Networks Corp., 342 Clark Street, Worcester, MA 01606; (617) 852-5400. *Circle No. 184*

LITERATURE

Grivet Catalog from Gallaher

Gallaher's 1979 Grivet Series Catalog contains drawings and 100 pages of design data in a 3-ring binder. The catalog lists parts and materials needed to construct over 1000 configurations, including a two-foot motorized box; a multi-legged, insect-like creature; and a seven-foot, two-legged, dual-armed android. DC motor controllers and positional feedback boards permit interfacing the robots to a microprocessor. The catalog costs $10 from Gallaher Research, Inc. P.O. Box 10767, Winston-Salem, NC 27108. *Circle No. 185*

74-Page Catalog from Data Translation

Data Translation's free 1978-1979 catalog contains 74-pages of technical specifications, pricing and ordering information for the company's product line. Described are microcomputer analog I/O systems for the DEC LSI-11/2 and LSI-11; the Intel SBC-80; the Computer Automation LSI-1, 2, 3, and 4 Series; the Zilog Z-80 MCB and MCS Series plus the National BLC-80, IMP and PACE families. Busable Data Acquisition Modules, special purpose D/A converters, a Programmable Real Time Clock for the DEC-LSI-11 and a selection of DC/DC converters are also described. Contact Data Translation, 4 Strathmore Rd., Natick, MA 01760. *Circle No. 186*

Monthly Review of New Software Products

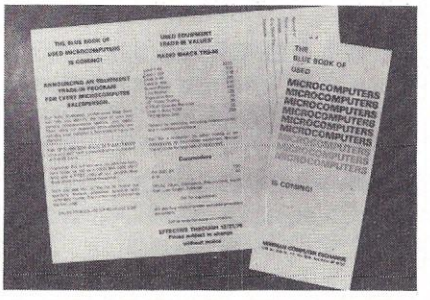
Users of Northstar BASIC can receive a free subscription to John Dvorak's Software Review. Each month, the Review examines new software packages and reports on the relative merits and values of the products. Many older and overlooked products are also seen in the pages of the newsletter, Dvorak said.

A software-only dealer, Dvorak said he writes the review to help his customers pick and choose. At the moment his mailing list has focused on users of Northstar BASIC, but he plans to introduce a newsletter for users of CP/M oriented systems, TRS-80 and eventually Apple.

For a free subscription write to J. Dvorak, 704 Solano Ave., Albany, CA 94706. State your computer system configuration. *Circle No. 187*

NCE/CompuMart Price List

NCE/CompuMart has published a wholesale price list for popular brands of personal computers. This pocket-sized guide lists the prices NCE will pay for equipment and tells how to obtain a formal quotation for a particular machine. To obtain your free copy of the list, contact NCE/CompuMart, Inc., Department PCB, P.O. Box 8610, Ann Arbor, MI 48107. *Circle No. 188*



MIC's Microcompututer Evaluation Series

Management Information Corporation is introducing a new series of reports dealing with the evaluation of microcomputer systems – *Business Microcomputer Evaluations.* Each report contains two evaluations of business microcomputers, analyzing the equipment, programs, prices and service capabilities of the manufacturers. These reports are designed to meet the selection needs of the personal computer user and small businessman.

Business Microcomputer Evaluation – I, the first in this series, reports on Radio Shack's TRS-80 and the Apple II computer. Both evaluations describe up-to-date features and capabilities of each of the systems. The report is available for $10 ($15 outside the U.S. and Canada). Contact Management Information Corporation, 140 Barclay Center, Cherry Hill, NJ 08034; (609) 428-1020. *Circle No. 189*

KIM-1 Users Notes Expands

KIM-1 User Notes, a 6502 newsletter with over 2100 subscribers worldwide, is now known as User Notes: 6502. The publication is expanding its coverage to include the Synertek SYM and Rockwell AIM machines. It will offer twice as much information in a brand new format, with KIM continuing to get the most coverage.

Subscribers' rates are $13/6 issues (U.S. & Canada first class) and $19/6 issues elsewhere (U.S. funds only). For more information contact User Notes: 6502, Eric C. Rehnke, Publisher, P.O. Box 33093, North Royalton, OH 44133; (216) 237-0755. *Circle No. 190*

Graphics Display Terminal Coverage Added to Auerbach Data Communications Reports

A new section, designed to cover the graphics display terminal market, has been added to the Auerbach Data Communications Reports.

Contained in a three-volume loose-leaf service, the reports include information on such manufacturers as Tektronix, Imlac, Magnavox Display Systems, Sanders Associates, Megatek, Hewlett-Packard and Ramtek.

Additional reports on terminals contain data on teleprinters, alphanumeric displays, remote batch terminals and intelligent terminals. More than 450 models of terminals from over 130 different manufacturers are included in these sections.

The Auerbach Data Communications Reports is a monthly updated reference service covering data com-

munications equipment. For more information contact Auerbach Publisher Inc., 6560 North Park Dr., Pennsauken, NJ 08109; (609) 662-2070. *Circle No. 191*

Systems Directory

Sentry Computer Services recently announced publication of a new 500-page *Directory of Systems Houses and Minicomputer OEMs.* This hardcover directory lists over 3000 systems houses, turnkey systems suppliers, dealers and other "resellers" of minicomputers.

Four separate indexes allow you to locate systems houses by name, by geographic location, by any one of over 100 application specialties and by the name of the firm's minicomputer supplier. An alphabetic index contains each firm's name, address, phone number, top executives, number of employees, annual sales, full description of each firm's products, the end user industries being serviced and the minicomputer models employed. The directory also features a detailed demographic profile of the OEM sector of the minicomputer market.

To obtain applications for free listings in the directory or to order copies, write to Sentry Publishing Division, Sentry Computer Services, Inc., 5 Kane Industrial Drive, Hudson, MA 01749. *Circle No. 192*

TRS-80 Users Notes

TRS-80 Users Notes is a bi-monthly, non-profit publication for owners and users of the TRS-80, published by Econo-Comp of Springfield, PA. Subscription rates are $6/year for U.S. and $7/year for Canada and other countries. For more information contact Econo-Comp at P.O. Box 157, Springfield, PA 19064. *Circle No. 193*

Free Booklet On Floppy Disks

Square One Co., a distributor and manufacturer of floppy disks and supplies, has released a 12-page booklet for floppy disk users and buyers. Entitled *The Floppy Disk, What You Should Know,* the booklet details the care and handling of the media, how to properly mail floppies and how they work.

Spokesmen for the company say that the booklet is useful for new personnel in office and word processing environments. The booklet is available free of charge. Contact Square One, 614 Eighteenth Ave., Menlo Park, CA 94025. *Circle No. 194*

TRS-80 Protection

A new flyer from Electronic Specialists describes protection for the TRS-80 against AC power line surges caused by large equipment or lightning. Also covered are causes and cures of AC line hash, which often creates glitches or false instructions on the TRS-80. Flyer TRS-PC is available for a stamped, self-addressed envelope from Electronic Specialists, Box 122, Natick, MA 01760. *Circle No. 195*

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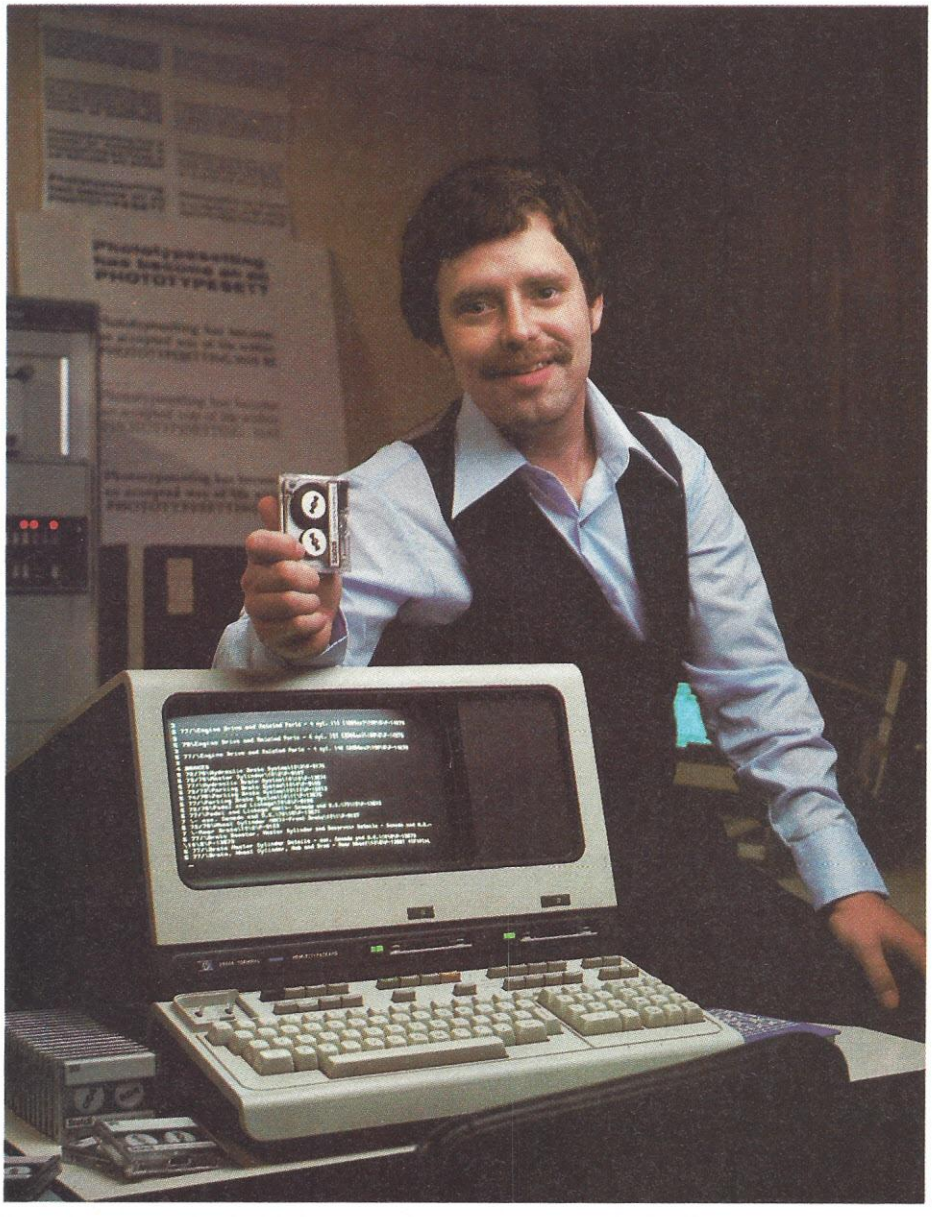

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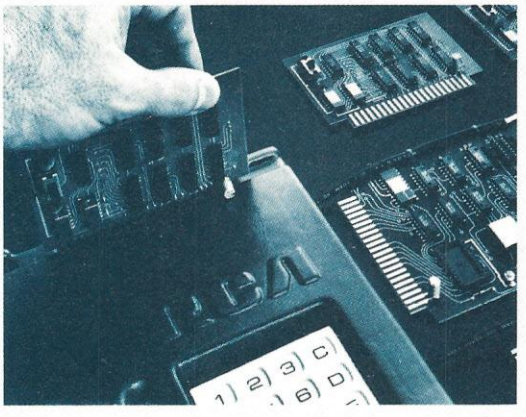

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